Reliance HY-CROME *Spring Washers*

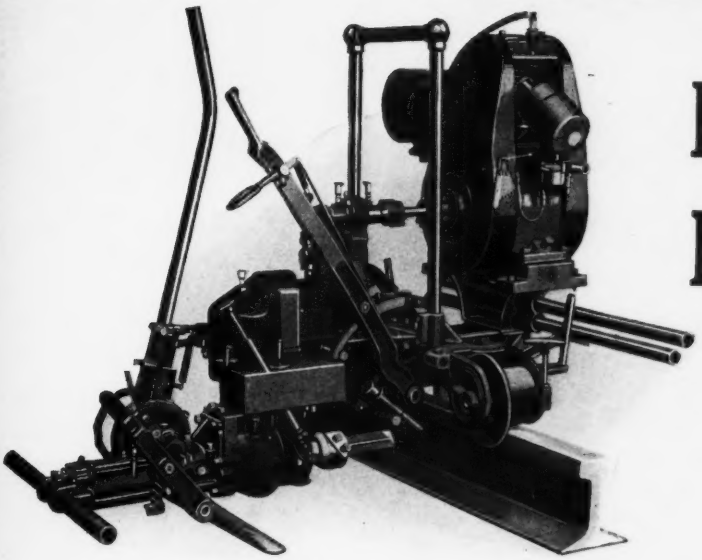
HY-PRESSURE HY-CROME
Edgemark of Quality

LEADERSHIP

• Introducing HY-PRESSURE HY-CROME —an achievement in developing a superior joint spring washer which *exceeds* A.R.E.A. specifications. Again a HY-CROME® spring washer leads the field—as A·REA*ctive* HY-CROME did in *meeting* A.R.E.A. specifications. STANDARD HY-CROME, their pioneering ancestor, you will remember was the first straight coil, round edge alloy steel spring washer offered to the railroads. An opportunity to explain the improved features of HY-PRESSURE HY-CROME will be appreciated by our sales engineers.

EATON MANUFACTURING COMPANY
RELIANCE SPRING WASHER DIVISION
MASSILLON, OHIO

The Mercury
Cleveland • Detroit
NEW YORK CENTRAL SYSTEM



Everett Power M-W Machine

For 10 years the Everett M-W has been the standard power rail drill on practically all railroads.

Its design and construction insure the **utmost in facility of operation and in speed and accuracy of adjustment.**

It has made such astonishing records for economy that no road can **afford** to use any other means for drilling bolt holes.

It will drill up to 1½ inch holes through the web of rails any size from 65 to 150 pounds. It will drill web of rail through splice bars. It will drill rail when in track or out of track to within two inches of the end. It can be used for drilling **practically all holes** in switch layouts where minimum clearances obtain.

See our exhibit in spaces 107 and 108 at the Coliseum, Chicago, March 15th to 18th.

Raco Power Track Machine—for nut running and setting screw spikes.

Raco Tie Boring Machine—for boring holes for screw spikes and cut spikes.

RAILROAD ACCESSORIES CORPORATION

MAIN OFFICE

405 LEXINGTON AVENUE

(Chrysler Building)

NEW YORK

Published monthly by Simmons-Boardman Publishing Corporation, 105 W. Adams St., Chicago, Ill. Subscription price, United States and Possessions, and Canada, $2.00; Foreign $3.00. Single copies 35 cents. Entered as second-class matter January 20, 1933, at the postoffice at Chicago, Illinois, under the act of March 3, 1879, with additional entry at Mt. Morris, Ill., postoffice. Address communications to 105 W. Adams St., Chicago, Ill.

YES

"Fully 50 per cent of the expense of track maintenance is incurred at the rail joints. The same stresses which cause the rail to wear at the ends also cause the fastenings to work loose and the ballast to be disturbed. Anything that is done to lessen the number of joints makes for permanent economy in track maintenance and produces a collateral saving by reducing the shocks on the equipment. One thing that has been done has been to lengthen the standard rail from 33 ft. to 39 ft., reducing the number of joints in the track by 18 per cent. Another thing that has been done has been to weld into a single piece long stretches of rail in crossings, on bridges, in tunnels and elsewhere. This has been done experimentally on stretches up to one mile in length, with such success as to hold promise of additional permanent economies in the future."

From an article by Mr. L. A. Downs, President, Illinois Central System in the January issue of Railway Engineering and Maintenance.

Welded track on the D. & H. at Albany, N. Y.

Thermit welding rails on the D. & H. at Comstock, N. Y.

A 12,000 ft. stretch of long welded rails on the D. & H. at Schenectady, N. Y.

Mr. Downs

● Welding of rail into long, continuous stretches does hold promise of enormous permanent economies for the future.

If, as authorities agree, approximately 50% of track maintenance can be saved by eliminating rail joints, an entirely new picture of operating costs becomes apparent. For example, RAILWAY AGE reports that Class 1 railroads spent $456,000,000 in 1936 for maintenance of way. Assuming, as has been estimated, that 60% of this expenditure, or $273,000,000, was chargeable to track maintenance, the possible saving for last year was $136,000,000; an amount equal to more than 3% of the years total operating income for all Class 1 roads combined.

There is nothing fantastic or beyond achievement in the idea of effecting such savings through the use of continuous rails. Nor should the elimination of joints by means of welding be regarded as something that may evolve years hence. Right now, in this country, long Thermit welded rails, including jointless stretches up to seven thousand feet in length are giving good accounts of themselves; in some cases after four years of service in main line track. In Australia and Europe, where welded rails were first installed about 1928, railroads report similar satisfactory results with Thermit welded track. From the knowledge and experience gained through these early trial installations, the Thermit Rail Weld is rapidly being perfected to a point well beyond the experimental stage. The time is ripe. The means are at hand. The rest is up to the railroads.

Executive engineers and management officials are invited to write for a sixty-page illustrated report giving more details of the Thermit welding process and describing more fully the installations to date.

METAL & THERMIT CORPORATION, 120 BROADWAY, N. Y.
ALBANY • CHICAGO • PITTSBURGH • SO. SAN FRANCISCO • TORONTO

VISIT OUR BOOTH
SPACES 58, 59 and 60
NATIONAL RAILWAY
APPLIANCE EXHIBITION
Chicago—Mar. 15th to 18th

4,000 ft. rails ready for installing in one of two tunnels on the Northern Pacific in Montana.

THERMIT Rail WELDING

Welded tracks at Mechanicville, N. Y. on the main line of the D. & H.

Continuous, mile-long rails on the B. & L. E. at River Valley, Pa.

Installing long welded rails on the B. M. T. Subway in Brooklyn, N. Y.

ARE YOU READY TO MEET THE DEMANDS OF HEAVY HIGH-SPEED TRAFFIC?

COALING STATIONS

Several excellent coaling stations have been developed—most are of the electric skip-hoist type. Be sure to specify G-E motors and control when ordering new coaling stations. G-E motors are very sturdy — bearings are large, and the housing is designed to exclude dust and dirt, and prevent the escape of oil. Electric brakes are well balanced, and of low power consumption. Our application engineers are skilled in the co-ordination of motors and control for skip-hoists

GENERAL

G-E ELECTRIC EQUIPMENT WILL HELP YOU DO A BETTER JOB

THE rush of increased business — more trains on the go — means more work for maintenance-of-way gangs. Fast passenger schedules — maintained with flying speed-liners — test rails and bridge structures. Freight trains pound the tracks—on schedules 45 per cent faster than those of 1922, with train loads running up to thousands of tons.

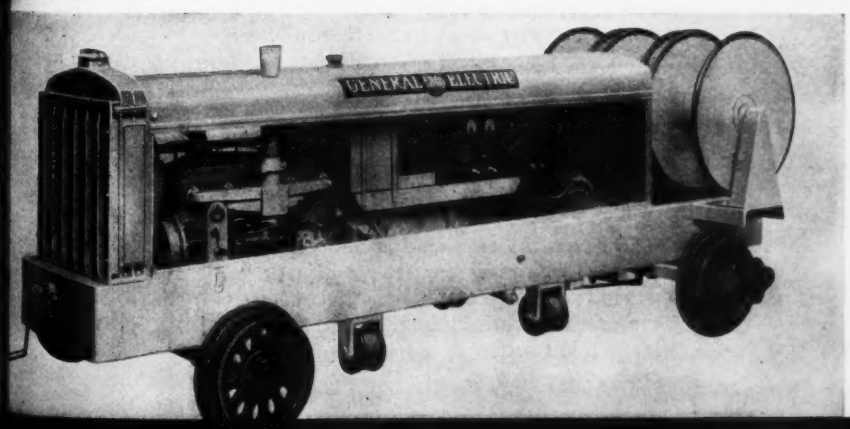
Battered rail ends must be built up to provide track over which trains can speed smoothly, and with perfect safety. Frogs and crossovers must not be allowed to become worn. Your tool in this work is the G-E electric arc welder—fast, economical, efficient.

Uninterrupted operation of the steam railroad depends upon the efficiency of its water system. For supplying water, electric motors, driving modern pumps, provide not only the surest but the most economical system. Records prove it!

Coaling stations are important, too, in the fast servicing of locomotives. Again electricity takes a hand and performs this important job better—and at less cost.

In these typical railway jobs, as in so many others, G-E electric equipment has proved itself superior—because it is designed by men who know railway requirements, and is backed by an organization of known engineering and manufacturing skill.

GENERAL ELECTRIC, SCHENECTADY, N. Y.



WATER SERVICE

Many railroads are cutting the cost of their pumping stations, and eliminating interruptions of service, by the use of electric power, modern pumps, G-E motors and control, and other electric equipment. Resulting savings pay for this investment in a few years. Operation of the pumping stations becomes automatic, and attendance is practically eliminated. Use G-E equipment to improve your facilities. Our engineers, located at strategic points throughout the country, will give expert service and assistance

ELECTRIC ARC WELDING

Only the G-E welder gives you ALL 3 major essentials for welding

Adequate self-stabilization — promotes a stable, flexible, "peppy" arc, making welding easier and faster. Reduces spatter loss 30 per cent

Dependable self-excitation—does away with separate-exciter inspection, maintenance, and brush-replacement expense. Gives added assurance of trouble-free welding

Simple duplex control—permits selecting of exact volts and amps for any job. Large knob and handle make adjustment easy with one hand

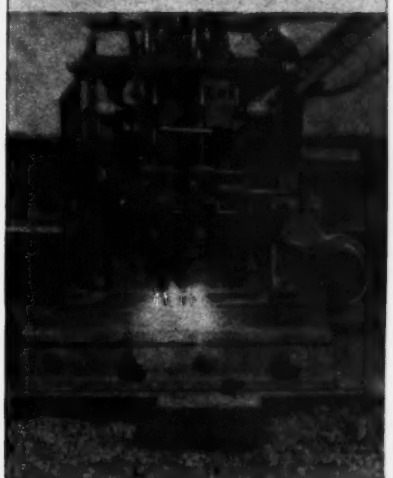
General Electric offers the most complete line of welding equipment on the market

E L E C T R I C

Oxweld Track Maintenance

Prepares the Way for 1937 Traffic

Rail bonds applied by Oxweld methods stay bonded, assuring trouble-free electrical connections between rail ends.



Hardening the ends of new rail by the Oxweld Process retards batter and adds years of smooth, efficient life.

OXWELD RAILROAD SERVICE

1912-1937

A QUARTER OF A CENTURY OF SERVICE TO THE MAJORITY OF CLASS 1 RAILROADS

STANDARD procedures have been developed by Oxweld for application wherever welding and heat-treatment by the oxy-acetylene process can contribute to maintenance-of-way efficiency. A few of these many applications which reduce maintenance costs and speed up track work are shown in the accompanying illustrations.

Oxweld procedures provide step-by-step control of every factor entering into the proper application of the oxy-acetylene process. These procedures are applicable throughout your program for maintaining safe, smooth-riding track.

For assistance in saving time and money in your maintenance-of-way work, consult Oxweld.

THE OXWELD RAILROAD SERVICE COMPANY

Unit of Union Carbide and Carbon Corporation

UCC

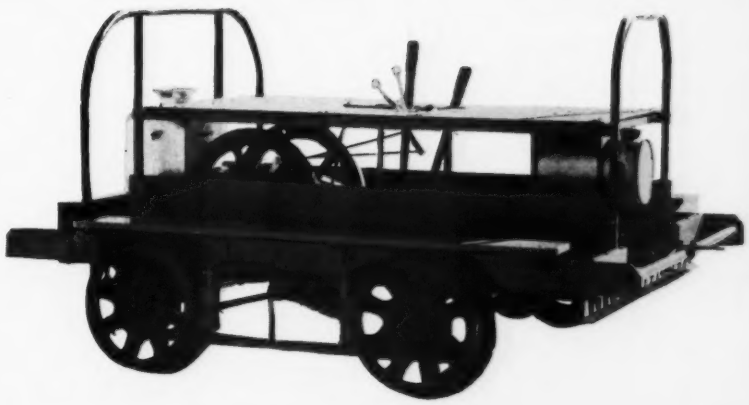
New York: Carbide and Carbon Building Chicago: Carbide and Carbon Building

Worn angle bars are rebuilt with wear-resistant Oxweld M. W. Welding Rod at a fraction of the renewal cost.

Worn switch points, as well as frogs and rail ends, built up with Oxweld M. W Welding Rod, last longer than before.

S2 SERIES D

S2 SERIES E



STANDARD SECTION CAR

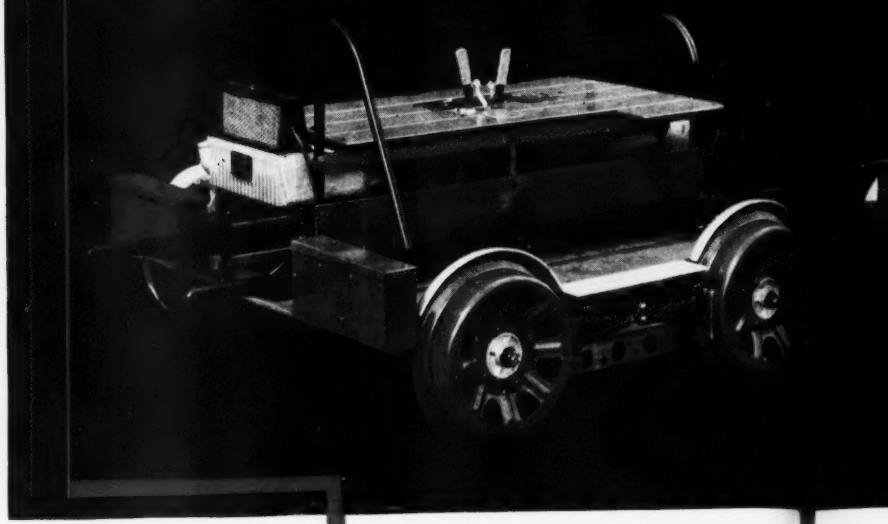
...is car measures up to all the require-...nts of section work. It has steel ...annel frame (lightened like aircraft ...ders) for rugged lightweight strength; ...lted construction for easy field repair; ...mfortable seating for eight men; two ...ep tool trays 69" long, 12¼" wide; ...;" deck extension above 20" wheel ...give men safe footing when tool trays ...e full; demountable wheels for quick ...e changes without pulling hubs, re-...uging or re-aligning, and Fairmont's ...ll known QBA 13 H.P. Engine for ...ety of power. Rides more like a pull-...n than a section car.

LIGHT SECTION CAR

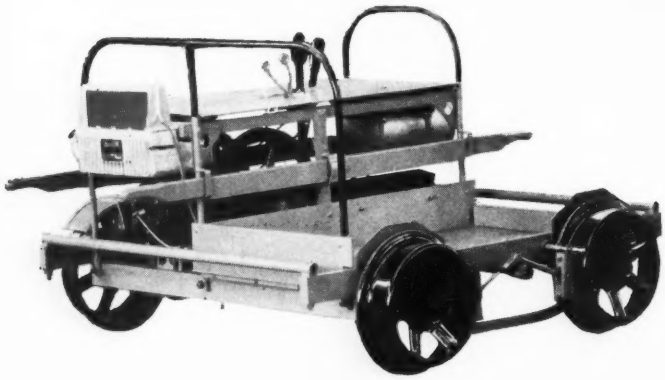
A new full 8-man section car with 1,300 lbs. capacity, weighing 875 lbs. and powered by the QBC 13 H.P. Engine. This car meets the demand for reduced weight with plenty of power and full accommodation for men and tools—plus rugged strength. This combination is produced by the use of high tensile alloy steel in the frame members and by simplified design. The bearings are Timken, the axles are S.A.E. 1045, and it is equipped with Fairmont demountable wheels. In every respect this car is ample for all section services and has commodious tool trays for the storage of long track tools. It makes possible, for the first time, an 875 lb. car with a QBC Engine.

Fairmont

M19 SERIES D



59 SERIES C



ONE-TO-TWO-MAN INSPECTION CAR — LIFT 101 POUNDS

This car, with frame of white oak, weighs 525 lbs., with a rear lift of only 101 lbs., and it is equipped with Fairmont extension handles that pull out at either end. It provides plenty of usable space (nearly 8½ square feet) around the battery cases and water cans, with a single tray 45″ long and 27″ wide. The famous Fairmont 8 H.P. engine furnishes power and to spare for capacity loads with a full size windshield. Safety features include, four wheel brake, self centering iron-lined shoes, Timken bearing, belt control and long starting crank with outboard support. This car can be used in light section service when it is equipped with draw-bar and toolbox measuring 5 ¾″ x 5¾″ x 63¼″.

ONE-TO-FOUR-MAN INSPECTION CAR ALUMINUM

LIFT 96 POUNDS

Alco-Aluminum frame and 89 alumi parts give it lightest lifting weigh any car in this classification. Exten handles extend *front or rear*. Ver spring mountings "float" the en Spring-mounted body and deck, in ing axle box guides operating in " ite" bushings. Surplus powered by famous Fairmont 5-8 H.P. engine. mountable wheels save 20% to renewal cost.

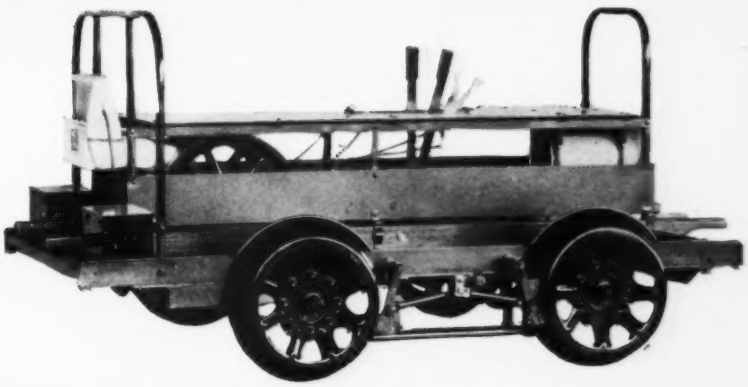
ONE
INSP
ALU
LIFT 85

Fair

M9 SERIES B

M14 SERIES D

M14 SERIES E



ONE-TO-TWO-MAN INSPECTION CAR ALUMINUM

LIFT 85 POUNDS

o other car in the field compares with e M9. Light weight without sacrifice strength is attained by the use of askelite, Aluminum Alloy and other odern metals. It has the major safety ctor of center loading; Fairmont's mous model O Engine for surplus wer; two safe trays 40¼" x 15", four eel brake, steel faced aluminum eels and long-life torpedo-proof de-untable wheels.

ONE-TO-SIX-MAN SECTION CAR ALUMINUM — LIFT 96 POUNDS

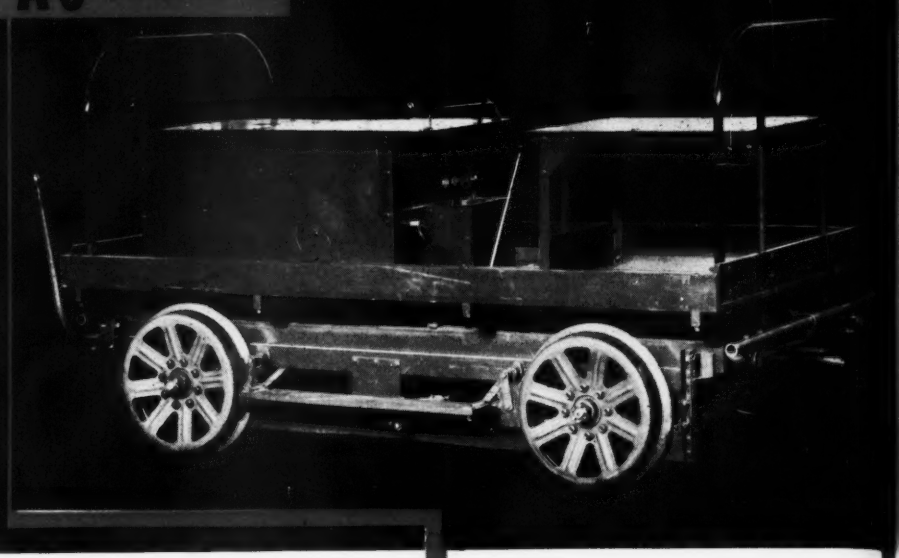
The M14 Series D is a modern car with a proved record, meeting the need for a strictly one-man light section car that can really perform with a full crew. 70 aluminum parts reduce the weight to 640 lbs. and extension handles (operating front or rear) enable one man to handle it easily. Surplus powered by Fairmont's famous Model O Engine and can be equipped with two-speed gear for hauling extra trailers.

M14 Series E—Steel Frame . . . The same car in every respect except that it has frame construction of reinforced steel. Weighs 720 lbs. with lift of 105 lbs. . . . made to combine low initial cost with low operating cost.

maintenance

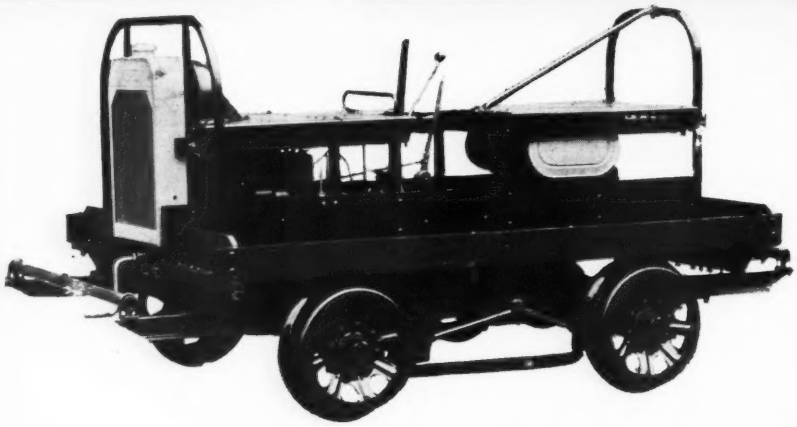
ont

A6 SERIES B



A5 SERIES B

A3 SERIES B



GANG CAR 36 H.P.

REAR LIFT 394 POUNDS

The A5 Series B is equipped with the Fairmont Reverse Gear for four all-gear driven speeds in either direction, qualifying it for every type of service. Its power plant is the 36 H.P. Waukesha Engine. It has the safety feature of center cockpit control for clear vision front and rear, differential loose wheel axle, iron lined brake shoes, demountable wheels and bolted frame construction for easy field adjustments.

A3 Series B—B & B and Extra Gang Car . . . 20 H.P.

Adoption of the Hercules Engine now permits equipment with generator, battery, self-starter and headlights. Delivers more power at lower cost. Equipped with Fairmont four-speed heavy duty reversible transmission. Also has center cockpit control.

GANG CAR

The A6 is the only spring mounte in its field, a factor that adds l years of life to the engine and car as the result of insulation from shock and vibration. This car proved that it has both the power stamina to more rapidly handle largest extra gangs and to develop speed and depth with discing e ment. Propeller shaft drive, a l directional gear, and $1\frac{1}{16}$" axles handle all power the Ford V-8 e exerts with 3000 lbs. load on axle: 900 lbs., drawbar pull if adh is 30%. Has center cockpit contro four speeds in either direction.

Fairmont

Dependable—Efficient and Economical . . . . .

SUMMER AND WINTER—in blistering hot weather or zero temperatures when the right of way is covered with ice and snow you will always find an ARDCO Automatic Rail Lubricator working.

And you will find ample evidence of efficiency—grease right on the throat of the rail where you need it—way around to the end of the curves you want lubricated.

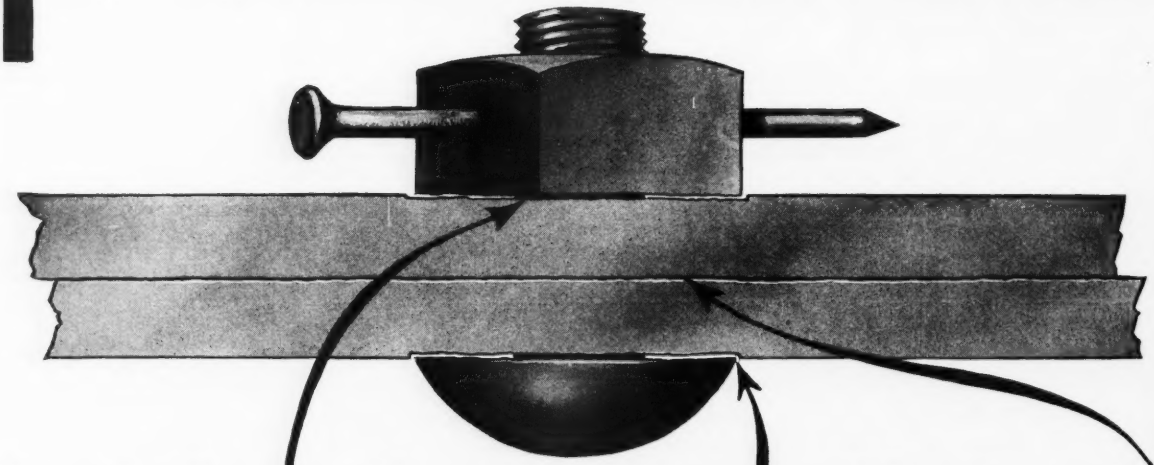
You do not have to worry about ARDCO Automatic Lubricators wasting grease or requiring periodical attention. Performance of hundreds of installations prove that they are exceptionally economical to operate and maintain.

The dependability, efficiency and economy of ARDCO Automatic Lubricators insure maximum returns from rail lubrication.

ARDCO MANUFACTURING CO.

1 NEWARK ST. HOBOKEN, N. J.

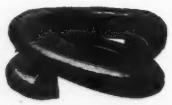
IF A SPIKE WERE DRIVEN THROUGH A TIGHTENED NUT and BOLT—THROUGH BOTH —SO THE NUT COULD NOT TURN LOOSE



then vibration would cause wear and inevitable looseness HERE and HERE and HERE

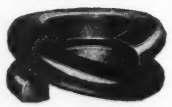
...how could it help it?

1 IMPROVED HIPOWER



2 DOUBLE HIPOWER

3 NATIONAL RIB WASHER



4 ANKOR HIPOWER

5 NATIONAL COLLAR GROOVED

6 THACKERAY SPRING WASHER

ONLY A SPRING WASHER CAN COMPENSATE FOR SUCH WEAR BY EXPANDING AND MAINTAINING BOLT TENSION UNTIL THE TRACK MAN COMES AGAIN..*only a spring washer!*

That is why Hipower Spring Washers more than pay for themselves in reduced upkeep costs—less labor and maintenance—fewer renewals and repairs.

Hipowers prolong the life of rail and of all joint parts.

Hipowers give an added safety factor to track.

Over 50 years of research and improvements—over 50 years of tests and trials—over 50 years of widespread use by leading railroads prove our spring washers to be one of the best railroad investments.

THE NATIONAL LOCK WASHER COMPANY, Newark, N. J.

Spring Washers • Retaining Rings • Drop Forgings • Car Window Equipment • Railway and Bus Windows

EVEN IN TIMES OF EMERGENCY

You Can Depend on Armco Culverts

After the Flood: **Just 2 hours and 15 minutes was required to place this twin 72-inch Armco culvert, bolt the connecting bands and begin backfilling.**

CHECK THESE ADVANTAGES

1. Less subject to damage by high velocities, undercutting, and soft, shifting foundations.
2. In case of washouts, Armco pipe generally can be hauled back into place and reinstalled without serious damage.
3. Prompt delivery and quick, easy installation of Armco pipe helps you save time and money on emergency replacements.

Floods . . . fires . . . and earthquakes simply emphasize the superior reliability and economy of corrugated metal drainage structures.

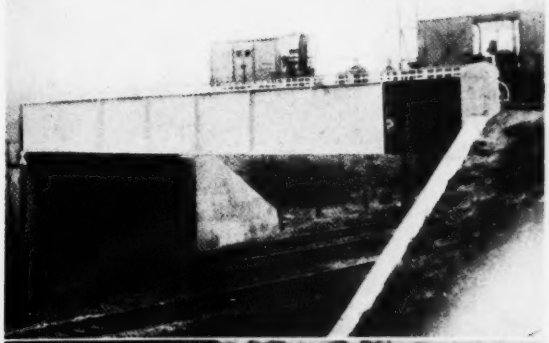
Even when subjected to the severest conditions, these sturdy, flexible drains come through with *less damage and greater salvage value* than any other type of drainage structure. On emergency replacements, too, the prompt delivery and quick, easy installation of Armco pipe enables you to restore normal schedules with the least delay.

Reap these important advantages in all your drainage construction by demanding *Asbestos Bonded* Armco pipe. Our nearest office is ready to give you capable and helpful assistance. Ingot Iron Railway Products Co. (Member of the Armco Culvert Mfrs. Assn.) Middletown, Ohio • Berkeley, California Philadelphia • Dallas • Atlanta • Salt Lake City • Minneapolis • Los Angeles • St. Louis • Portland Cleveland • Spokane • Chicago Richmond • Houston • Denver.

ARMCO

ASBESTOS BONDED • ARMCO PAVED INVERT PIPE

Maintenance Costs Cut with these 3 processes



Rail End Welding

Building up and heat treating rail ends is one of the most important operations performed by maintenance engineers of Airco railroad customers. It assures comfort to travellers, smooth handling to shippers, and efficiency and economy in maintenance programs to the railroads. Our engineers would be glad to discuss rail end welding and heat treating with you.

METALAYER

In the process known as MetaLayeR, any of the commercial metals can be sprayed on to any surface to form an adherent metal coating, permanently protecting the surface against corrosion and disintegration from air, water, gases, chemical fumes, acids, etc. At the left, the girders of a highway bridge are being coated with aluminum to protect against smoke corrosion.

Rail End Cropping

Using the Airco-DB Radiagraph, this new and faster method enables a road to profitably crop old and corroded rails in less time and at a fraction of the cost of other methods in common use. Actual cost data secured under working conditions from one road showed savings as high as 18 cents per finished rail end. With the scrap price of rail ends practically constant, this road made a profit of 12 cents on each rail end.

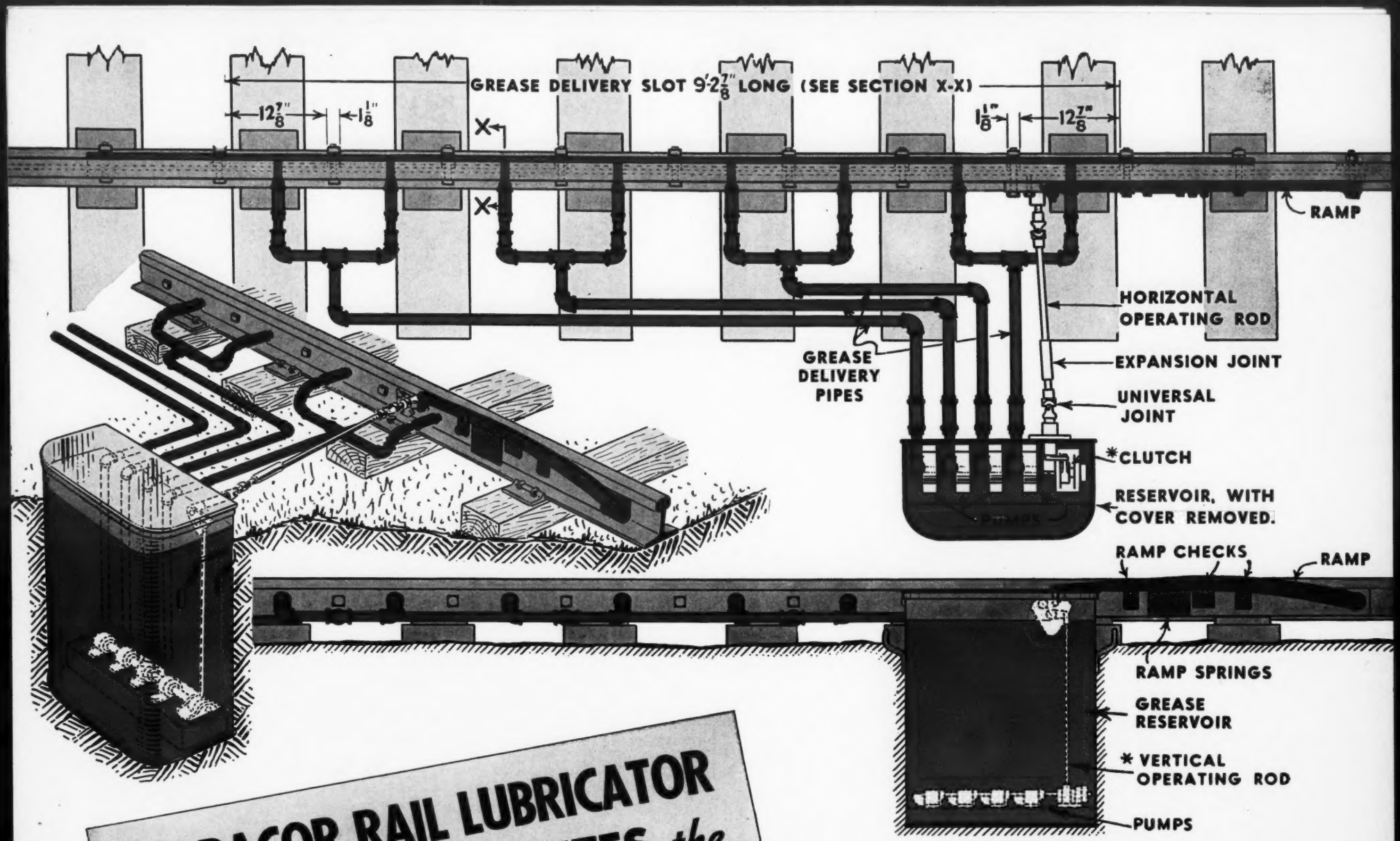
Airco Railroad Customers have reduced their maintenance costs to a minimum through the combination of Airco Oxygen and Acetylene, Airco-DB Apparatus, and Engineering Assistance.

Visit Airco's Booths
Nos. 181-182
N.R.A.A. Convention

AIR REDUCTION
SALES COMPANY

General Offices: 60 East 42nd Street, New York, N. Y.
DISTRICT OFFICES in PRINCIPAL CITIES

A NATION-WIDE WELDING and CUTTING SUPPLY SERVICE



The RACOR RAIL LUBRICATOR DISTRIBUTES the

Right GREASE

* NOTE — VERTICAL OPERATING ROD OPERATES GEAR PUMPS ON SPRING ACTUATED LIFT

GREASE DELIVERY SLOT

ON SPRING ACTUATED LIFT

Right AMOUNT *of* GREASE IN THE RIGHT PLACE

Extensive tests over a period of years have demonstrated that the Racor Rail Lubricator will apply more square inches of grease to the side of the rail head on curves and waste less grease along the right-of-way.

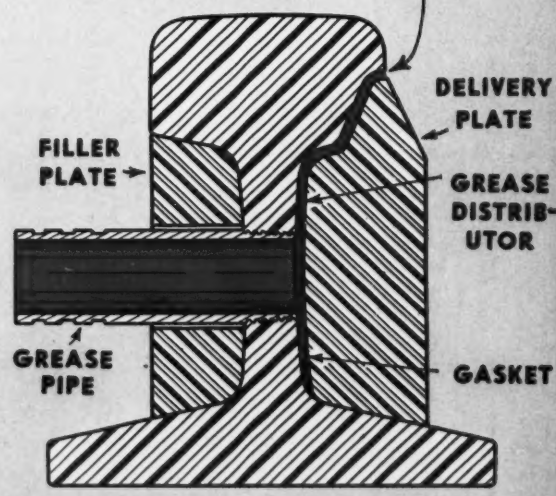
Here's How It Works

Four gear pumps, actuated by a ramp, deliver the lubricant through eight grease pipes to the chamber between the delivery plate and the rail, shown in section X-X.

Distributors on the delivery plate deflect the lubricant so that it is forced out of the delivery slot in a continuous line. The grease is thus picked up by the side of the flange in such a manner that the flange retains the maximum amount of lubricant on the surface coming in contact with the high rail of a curve and a minimum amount is wasted.

The operating parts of the Racor Rail Lubricator are of substantial construction, with flexible connections, and require only periodical inspection to see that the grease reservoir is filled and the few operating parts exposed to the weather are kept oiled.

GREASE DELIVERY SLOT 9'-2⅞" LONG DIVIDED INTO 8 DELIVERY SPACES (EACH 12⅞" LONG) BY SHIMS AT BOLTS WHICH MAINTAIN THE WIDTH OF DELIVERY SLOTS ACCURATELY.



SECTION X-X

RAMAPO AJAX CORPORATION

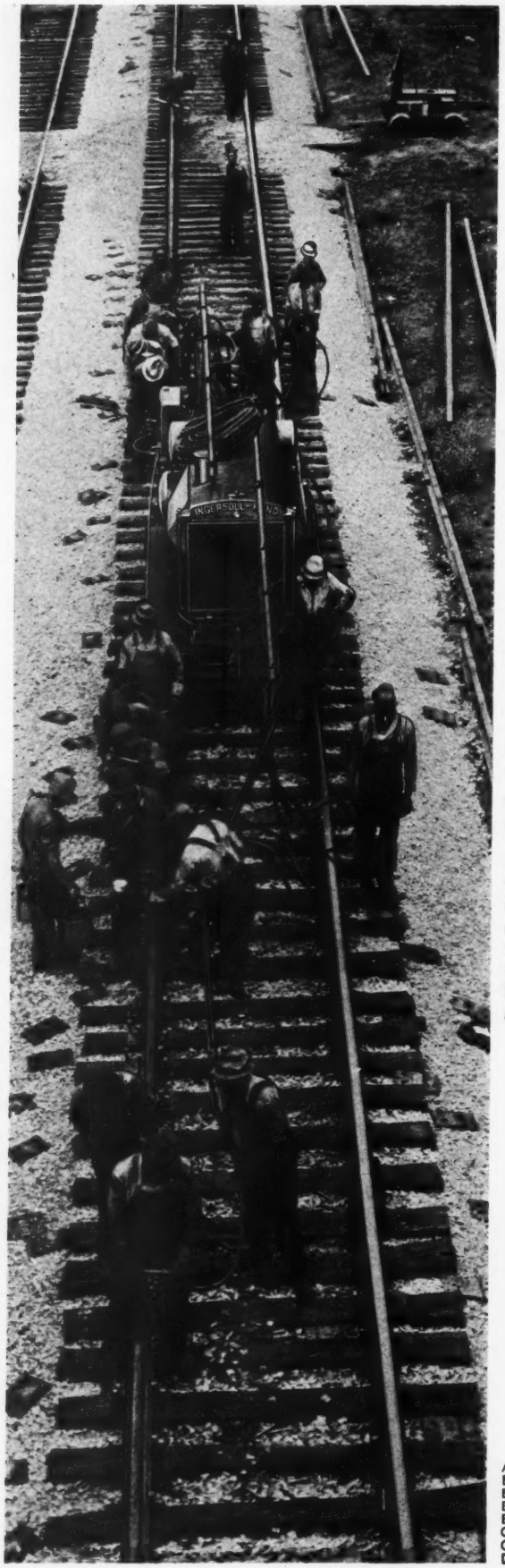
CANADIAN RAMAPO IRON WORKS, LIMITED

RACOR TRADE MARK REGISTERED

General Offices
230 PARK AVENUE, NEW YORK

Racor Works

CHICAGO, ILL.
EAST ST. LOUIS, ILL.
HILLBURN, NEW YORK
LOS ANGELES, CALIF.
NIAGARA FALLS, N. Y.
NIAGARA FALLS, ONT.
PUEBLO, COLO.
SEATTLE, WASH.
SUPERIOR, WIS.



AIR-OPERATED

Spike Drivers Wrenches and Tie Tampers

Assure Faster and Better Work at LOWER COST

WITH I-R Pneumatic Spike Drivers, straight spikes can be driven in about 3½ seconds each; screw spikes in 6 seconds from a set-up position!

With I-R Pneumatic Wrenches, a 6-bolt rail joint can be bolted up in 30 seconds!

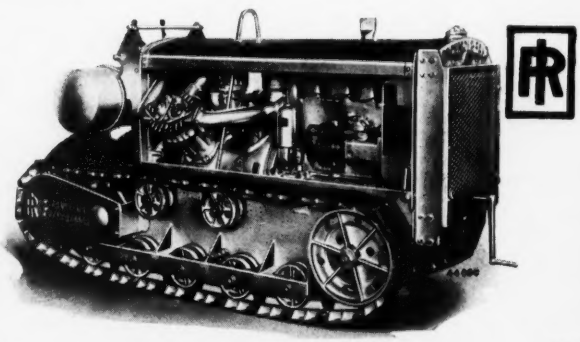
With I-R Pneumatic Tie Tampers four men will tamp as much track as 12 to 14 men with picks or bars!

These tools work just as fast, and just as efficiently at the end of the day as they do early in the morning—economy begins the moment you place them in service!

Every indication points to a big increase in railway traffic during 1937. Trains will move at higher average speeds—loads will be heavier—your men will be called upon to maintain almost perfect track conditions!

Why not assist them with modern track maintenance facilities?

I-R Pneumatic Equipment such as spike drivers, spike pullers, power wrenches, tie tampers, wood borers, rail drills, etc.—used in conjunction with I-R two stage, air-cooled compressors are now demonstrating their outstanding money and time-saving value on numerous important railway systems. This equipment will enable your men to handle track maintenance operations faster—better—and at far less cost.



471-11

Ingersoll-Rand

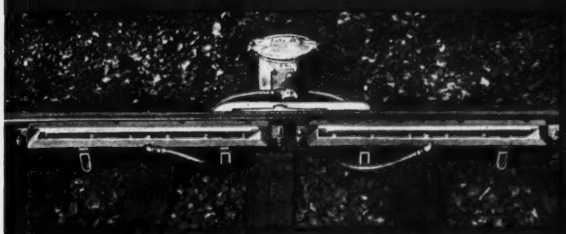
11 Broadway, New York City

Atlanta	Denver	Los Angeles	Salt Lake City
Birmingham	Detroit	Newark	San Francisco
Boston	Duluth	New York	Scranton
Buffalo	El Paso	Philadelphia	Seattle
Butte	Hartford	Picher	St. Louis
Chicago	Houston	Pittsburgh	Tulsa
Cleveland	Knoxville	Pottsville	Washington
Dallas			

[redacted]

RAIL *and* FLANGE LUBRICATORS

Used by leading Railroads for the following reasons:



1 MECO lubrication practically eliminates curve-rail wear caused by wheel flange friction, and increases the life of the high rail from two to four times.

2 MECO lubrication greatly prolongs the life of high rail in curves which would otherwise be scheduled for early replacement, because of allowable limit of flange wear.

3 MECO lubrication decreases derailment hazards.

4 MECO lubrication increases the life of low rails in curves, because trains can safely maintain higher speeds and the load on high and low sides is thus more nearly equalized. "Flowing" of low rail is reduced.

5 MECO lubrication reduces regauging and realigning costs.

6 MECO lubrication eliminates wheel screeching on curves.

MECO lubrication also (7) reduces wheel flange wear, particularly noticeable on locomotive wheels; (8) permits increased tonnage ratings through divisions where curvature governs such ratings; (9) reduces fuel consumption; (10) permits increased train speeds with safety; and (11) frequently does away with helper service.

Our advertisements in following issues of RAILWAY ENGINEERING AND MAINTENANCE will include evidence supporting each of the eleven statements enumerated herein.

Exhibit at N. R. A. A. Coliseum March 15-18

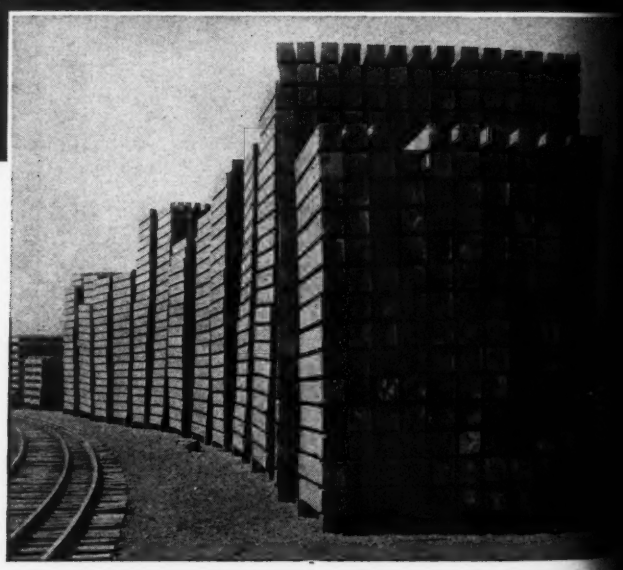
[redacted]

Booths 149-150

Featuring
TAR & CHEMICAL DIVISION
PITTSBURGH, PA.

serve th

KOPPERS COAL TAR ROOFING BEING USED TO RE-ROOF RAILROAD BUILDING—Coal Tar Pitch and Felt should always be used on flat deck buildings. Coal Tar Pitch possesses the ability to resist disintegration by water, even when the water lies on it for long periods, as on many flat roofs. These photographs show an old roof being taken off a Baltimore and Ohio Building in Pittsburgh and a new Koppers Roof being applied. Let us send you the Koppers Roofing Specification Book.

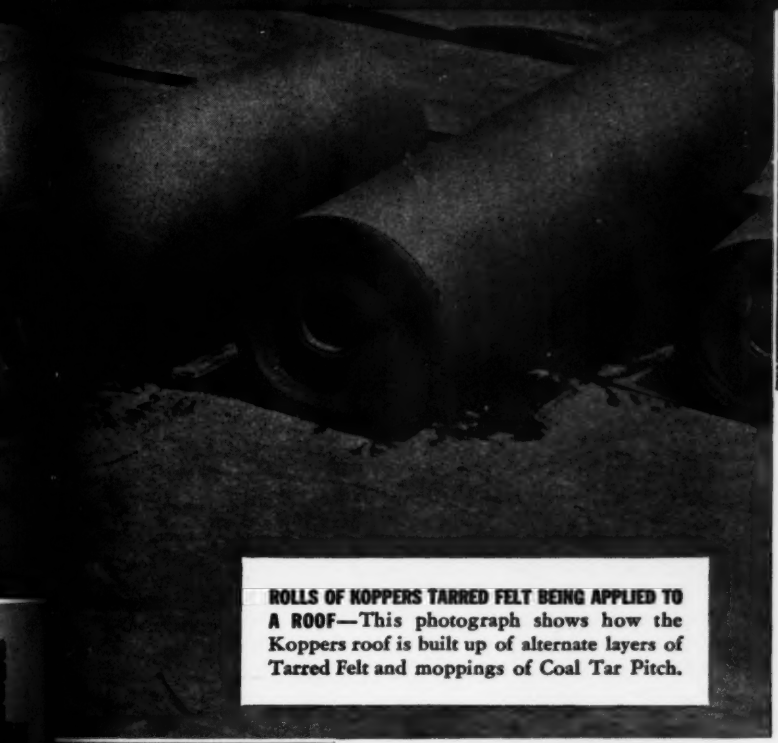


PRESSURE-TREATED TIES AT A WOOD PRESERVING CORPORATION PLANT, READY FOR RAILROAD USE—The Wood Preserving Corporation, Koppers subsidiary, supplies railroads with pressure treated ties, piling, bridge and dock timbers, poles, cross arms, fence posts, crossing plank, cribbing, conduit and car stock. Wood is treated with creosote or with salt preservatives, depending upon the use to which it is to be put.

KOPPERS COMPANY . . DESIGNERS . . BUILDERS . . PRODUCERS . . MANUFACTURERS

KOPPERS

e the railroads . . .



ROLLS OF KOPPERS TARRED FELT BEING APPLIED TO A ROOF—This photograph shows how the Koppers roof is built up of alternate layers of Tarred Felt and moppings of Coal Tar Pitch.

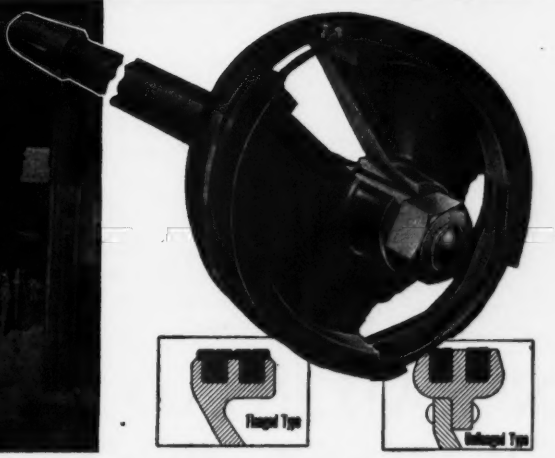
THESE TANK CARS INSULATED AND JACKETED BY BARTLETT HAYWARD DIVISION, BALTIMORE—10,000-gallon tank cars, part of a contract of 65, insulated and jacketed for the Pan American Petroleum and Transport Company. This work was done by the Bartlett Hayward Division of Koppers Company at Baltimore.

●

Koppers Divisions, Subsidiaries and Affiliates Serving the Railroad Field

THE WOOD PRESERVING CORPORATION	PITTSBURGH, PA.
NATIONAL LUMBER & CREOSOTING CO.	TEXARKANA, ARK.
TAR AND CHEMICAL DIVISION	PITTSBURGH, PA.
THE KOPPERS COAL COMPANY	PITTSBURGH, PA.
BARTLETT HAYWARD DIVISION	BALTIMORE, MD.
AMERICAN HAMMERED PISTON RING DIVISION	BALTIMORE, MD.
WESTERN GAS DIVISION	FORT WAYNE, IND.
THE WHITE TAR COMPANY OF NEW JERSEY, INC.	KEARNY, N. J.
THE MARYLAND DRYDOCK COMPANY	BALTIMORE, MD.
GAS AND COKE DIVISION	PITTSBURGH, PA.

KOPPERS SUPPLIES COAL TO MANY RAILROADS—The Koppers Coal Company is one of the leading producers of coal.



AMERICAN HAMMERED PISTON RING DIVISION OF KOPPERS PRODUCES REVOLUTIONARY ADVANCEMENT IN CYLINDER PACKING RINGS—The American Hammered Combination Cast Iron and Bronze Sectional Rings give longer life for packing, for cylinders and for pistons. The American Hammered Piston Ring Division of Koppers also makes every size and type of piston ring for Diesel, gasoline and steam engines.

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KOPPERS COMPANY, Pittsburgh, Pa. REM-3
Send me information about

- ☐ Pressure-treated Ties, Poles, Posts, and other Treated Timber
- ☐ Bituminous Base Paints
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- ☐ Waterproofing
- ☐ Coal
- ☐ Tarmac for Paving
- ☐ Locomotive Packing Rings
- ☐ Piston Rings
- ☐ Fast's Couplings
- ☐ Creosote
- ☐ Fire Hydrants
- ☐ Pipe
- ☐ Tanks
- ☐ D-H-S Bronze Castings and Iron Castings
- ☐ Coal Handling Plants
- ☐ Coal Washing Systems
- ☐ Disinfectants
- ☐ Insecticides
- ☐ Deodorants
- ☐ Weed Killers

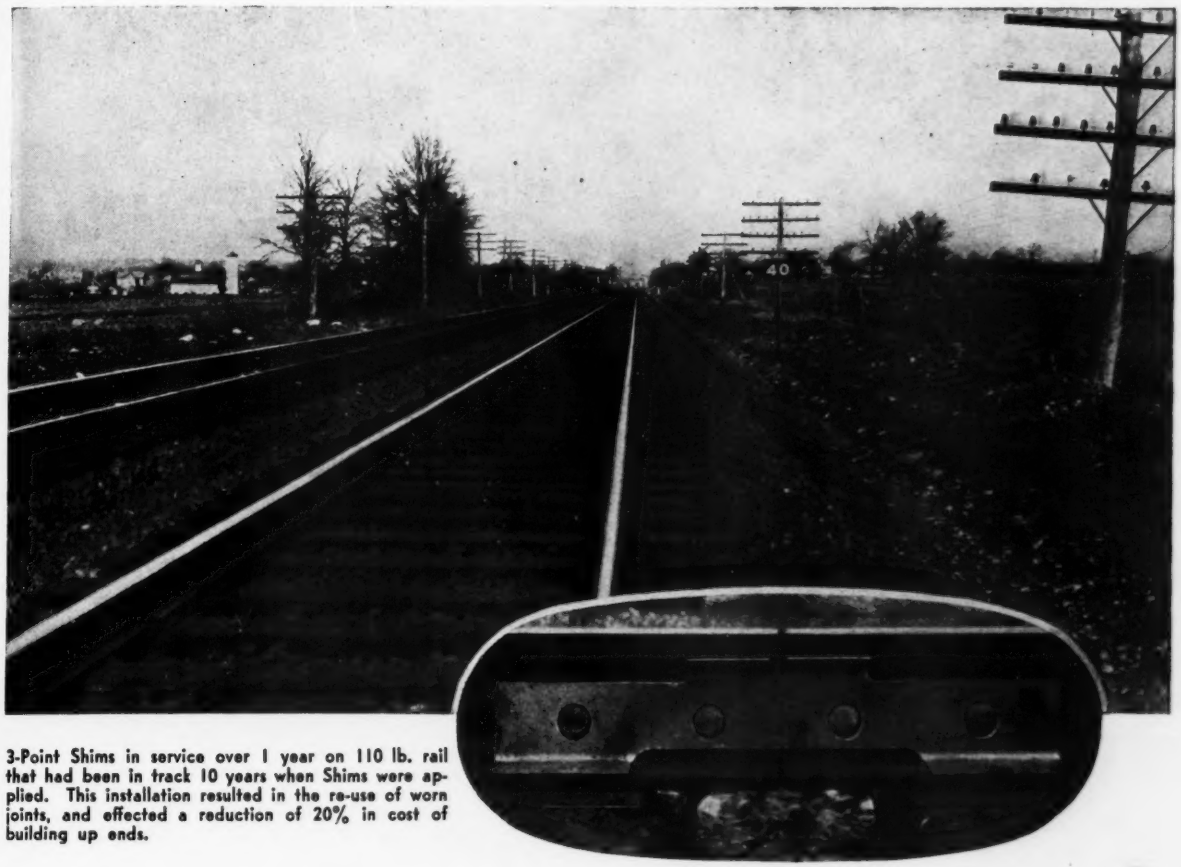
Your Name.....

Company.....

Address.....

ERS ISTRIBUTORS

3-Point Restoration Shims



3-Point Shims in service over 1 year on 110 lb. rail that had been in track 10 years when Shims were applied. This installation resulted in the re-use of worn joints, and effected a reduction of 20% in cost of building up ends.

Simple Supplied in Three Thicknesses Only, to fit All Four Hole and Some Six Hole Joints.

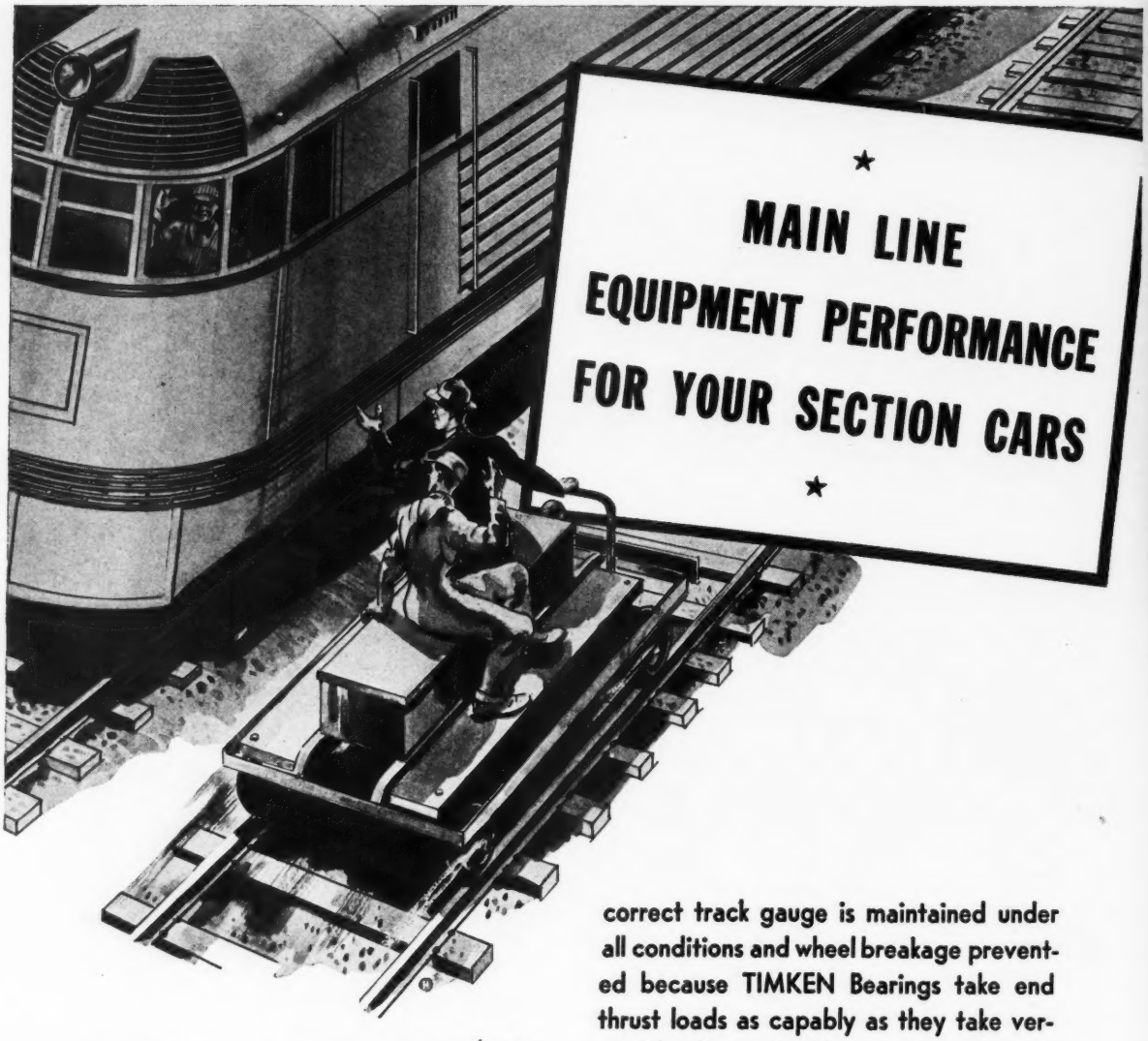
Economical An aid to Surfacing Joints to the Proper Level Before Building up Rail Ends.

Practical Restore Take-up and Compensate For Wear in Both Head and Base.

THE RAIL JOINT COMPANY, INC.

HUDSON TERMINAL BUILDING

50 CHURCH STREET NEW YORK, N. Y.

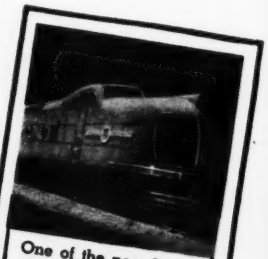


MAIN LINE EQUIPMENT PERFORMANCE FOR YOUR SECTION CARS

Section cars equipped with TIMKEN Bearings are as superior to plain bearing section cars in performance as are modern Timken-equipped trains to plain bearing train equipment.

They are faster and more dependable; require less attention for lubrication; possess greater endurance; and cost less for maintenance. Furthermore, with the axles mounted on TIMKEN Bearings the correct track gauge is maintained under all conditions and wheel breakage prevented because TIMKEN Bearings take end thrust loads as capably as they take vertical loads—and without any loss of anti-friction efficiency.

When buying new section motor cars and trailers it will pay you to specify TIMKEN Bearings. You can get them in most leading makes.



One of the new Union Pacific Streamliners operating on TIMKEN Bearings.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

Manufacturers of Timken Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; Timken Alloy Steels and Carbon and Alloy Seamless Tubing; and Timken Rock Bits.

TIMKEN

TAPERED ROLLER BEARINGS

DUFF-NORTON

RECOGNIZED LEADER IN DESIGN,
EASE OF OPERATION AND GEN-
L LIFTING EFFICIENCY AMONG TRACK
INTENANCE MEN FOR OVER 50 YEARS

No. 1 D
Double Acting
Track or Trip Jack
—15 tons capacity.

No. 117
Single Acting
Standard Trip or
Track Jack with
the suspended
pawl. Available in
19, 13 and 7½ inch
raises.

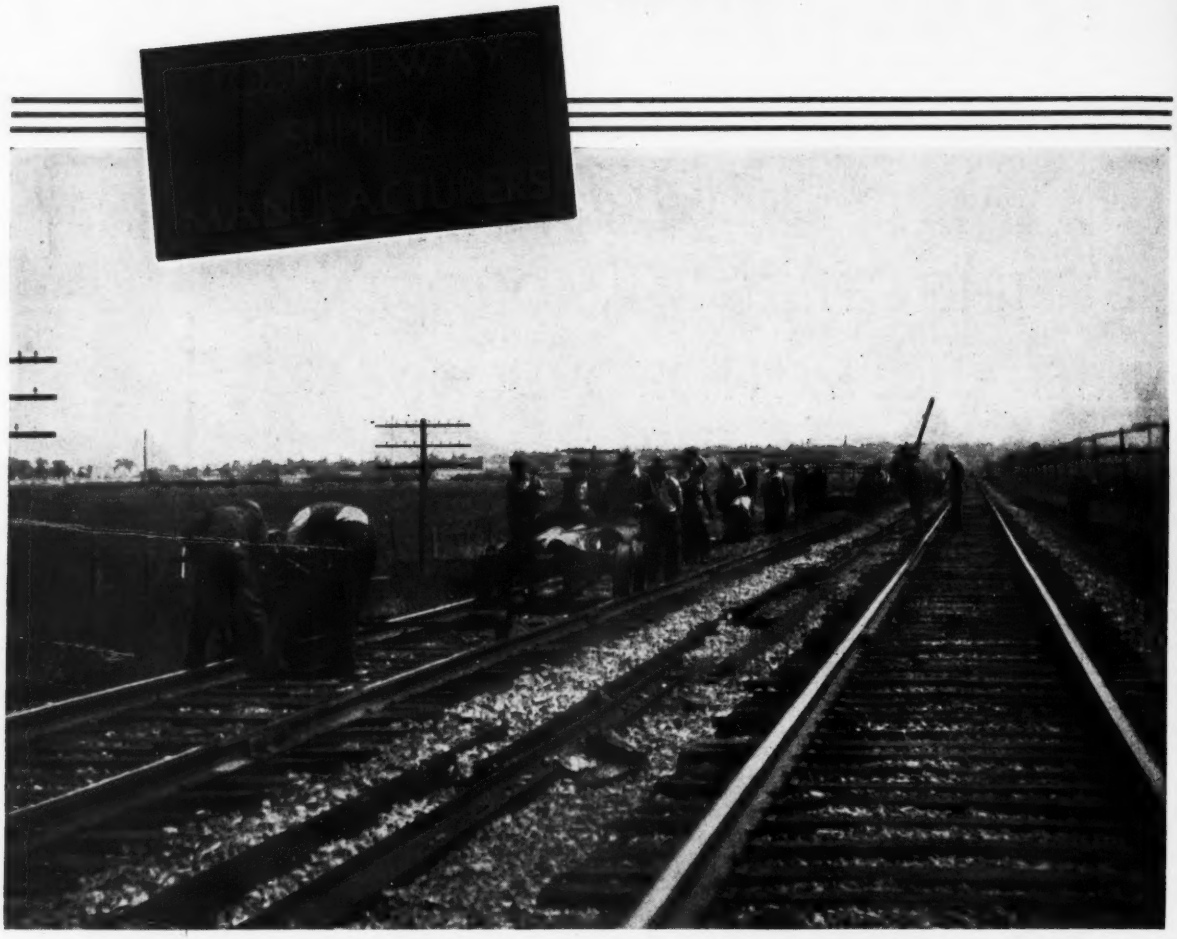
Duff Tie Spacer
Moves only the tie
to which Jack is ap-
plied . . . acts effec-
tively with any
make of track Jack.

No. 304
A Special Track
Jack designed with
a convenient foot-
lift at the *side* of the
frame for track
work in tunnels
warehouse sidings,
etc.

No. 110
Combination Trip
and Lowering Jack
15 tons capacity—
with footlift,—13
inch raise.

DUFF-NORTON MFG. CO.
PITTSBURGH, PA.

"THE HOUSE THAT JACKS BUILT"



As Rail Goes, So Goes Railway Maintenance

In 1932 the railways laid less than 400,000 tons of new rail in replacement; in 1935 they laid less than 600,000 tons.

For this year they have already ordered more than 1,000,000 tons and other orders are still to come.

With rail orders go orders for fastenings—for rail-laying equipment of a wide variety. Furthermore, new rail necessitates other track improvement.

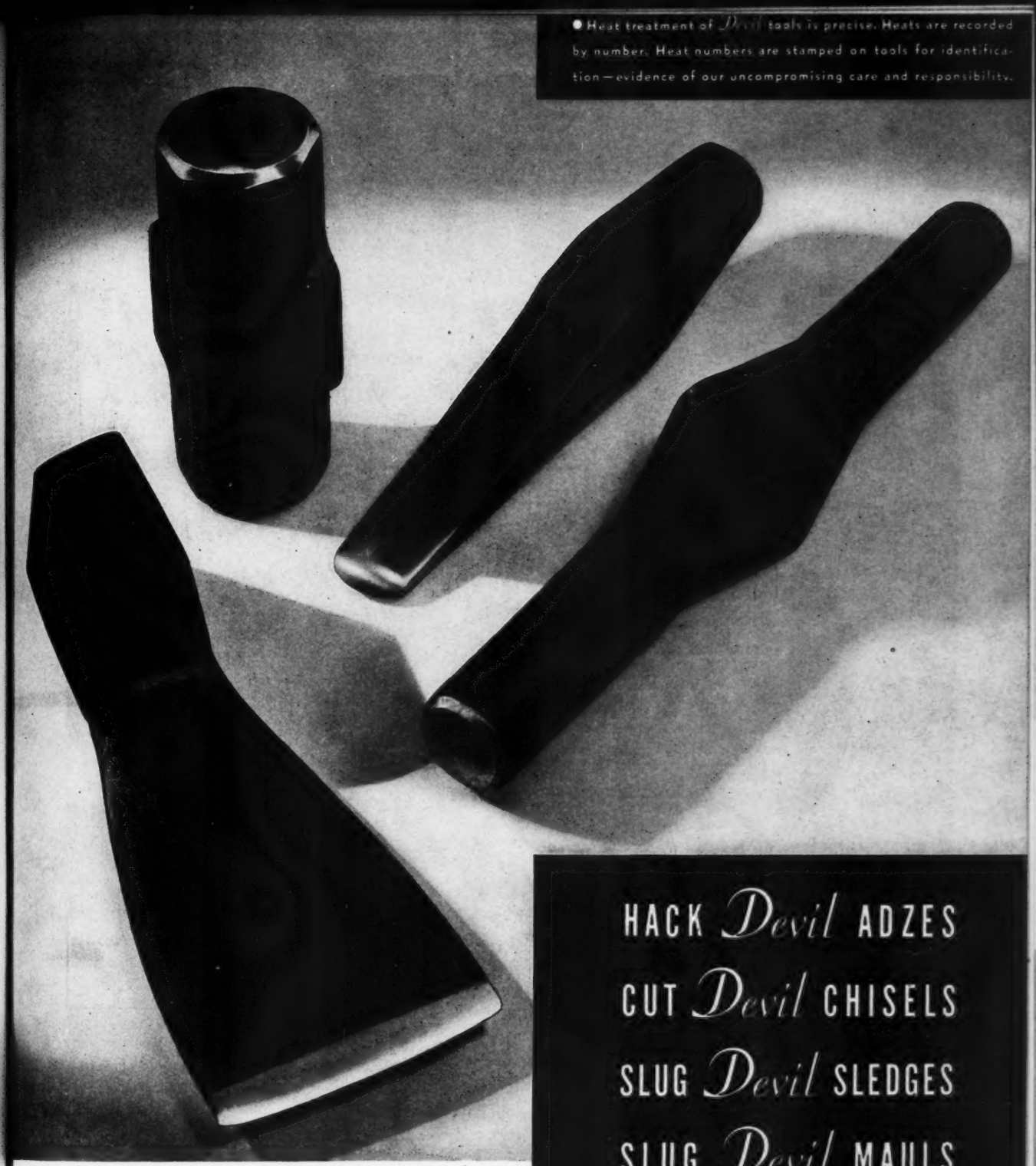
Even more, rail orders are a barometer of maintenance of way expenditures in general.

The railways are in the market. They are buying more liberally than for six years. Are they looking at your products? Do they know of your products?

Are you telling the story of your products and of the economies they will effect to the men who are selecting the materials and equipment that will go into this year's programs?

Are you including as an essential part of your 1937 sales program representation for your products in the magazine which these men read first of all?

RAILWAY ENGINEERING AND MAINTENANCE IS READ BY MAINTENANCE OFFICERS OF ALL RANKS



● Heat treatment of *Devil* tools is precise. Heats are recorded by number. Heat numbers are stamped on tools for identification—evidence of our uncompromising care and responsibility.

HACK *Devil* ADZES

CUT *Devil* CHISELS

SLUG *Devil* SLEDGES

SLUG *Devil* MAULS

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WARREN TOOL CORPORATION

Successor to THE WARREN TOOL & FORGE CO.

GENERAL OFFICES WARREN OHIO

THE simple truth about the *Devil* line of track tools may be summed up in two words: SAFETY and DURABILITY. Produced by pioneers in the use of alloy steel for track tools, *Devil* tools have been in ever growing demand for heavy duty in the hands of track gangs. If you are one of those who feel that SAFETY and DURABILITY come first, then "come first" to Warren Tool Corporation.

A NEW SHEFFIELD TAKES THE RAILS

FAIRBANKS-MORSE SHEFFIELD 52

A NEW Sheffield section car! A new companion to the Sheffields that today serve every major railroad!

Big and powerful, it carries a crew of 6 to 8 men—and yet it is so light that two men can pick it up and carry it. Speedy, it will run fully loaded at 35 m. p. h.—and at 18 m. p. h. carrying a 4000-pound trailer.

The power plant is a single cylinder, two-cycle, air-cooled engine of the reversible type. Unusually interesting features are its self-contained flywheel fan and housing, air-cooled clutch, ventilated spark plug, patented centrifugal crank pin lubrication, ground Lynite piston.

Comfortable, it carries its full crew without crowding, its tool trays carrying a full tool complement, including standard lining bars.

See it at the N.R.A.A. Show at the Coliseum in Chicago March 15-18

Before you buy any motor car, see the Sheffields—the most versatile, most complete line of motor cars serving railroading. Write for bulletin. Address Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Ill.

6952-RA21.10M

FAIRBANKS MORSE

DIESEL ENGINES • ELECTRIC MACHINERY PUMPS • FAIRBANKS SCALES • RAILROAD EQUIPMENT • FARM EQUIPMENT • HOME APPLIANCES • HOUSEHOLD PRODUCTS • HEATING AND AIR CONDITIONING EQUIPMENT

Railway Equipment

No. 99 of a series

Railway
Engineering and Maintenance

SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: WHO DOES THE "BUYING"?

February 27, 1937

Dear Reader:

What part does the maintenance officer play in the purchase of materials? What relation does he bear to the purchasing agent? These questions have come to me with increasing frequency of late, as new companies are attracted to the railways as a market for their products.

To such inquiries I am able to give a concise but complete answer -- an answer made by the chief purchasing officer of one of our most efficiently operated railways. In an address before the Pittsburgh Railway Club recently, U. K. Hall, general purchasing agent of the Union Pacific System, spoke on this question as follows:

> "It is not up to the purchasing agent to endeavor to dictate to users concerning the character of the materials that should be ordered. The using departments are most vitally interested in the operating expenses of their departments. They are technical experts who know what is best suited to their needs. They are the ones to specify special machines or equipment and, in conjunction with the laboratory or test departments, to specify the character of materials to be ordered. It then falls upon the purchasing agent to obtain to the best advantage the materials and supplies which, in the judgment of the using departments, are best suited to those needs."

This procedure is, of course, common knowledge to those of you who prepare requisitions for the materials that you need as a matter of daily routine. It is equally well known to those manufacturers who have, through the years, developed an efficient sales procedure. It is these manufacturers who present the stories of their products to you from month to month through our advertising pages.

In these days of such rapid and revolutionary development of materials and devices, I sometimes wonder if you are utilizing the full opportunity that is yours to familiarize yourselves with all the aids that are offered you through these pages. In other words, as you are developing the details of the larger programs that are facing you this year, are you searching these pages for the latest products of these progressive manufacturers? Are you taking advantage of the educational opportunities in the advertising pages?

Yours sincerely,

Elmer T. Howson

ETH:JMS Editor

MEMBERS: AUDIT BUREAU OF CIRCULATIONS AND ASSOCIATED BUSINESS PAPERS, INC.

TRUE TEMPER PRODUCTS FOR MODERN TRAFFIC CONDITIONS

Stead TRUE TEMPER Rail Anchors

The use of an adequate number of Stead TRUE TEMPER Rail Anchors will eliminate rail creepage and provide smooth riding track. Stead TRUE TEMPER Rail Anchors combine efficiency, economy and durability.

TRUE TEMPER Tapered Rail Joint Shims

1 Avoid the necessity of duplication of bars. **2** Installation of shims can be carried on without interruption to traffic. **3** Provide the most economical and practical method of restoring worn rail joints.

Published on the first day of each month by the

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Member of the Associated Business Papers (A.B.P.) and of the Audit Bureau of Circulations (A.B.C.).

Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

March, 1937

Visit the Exhibit

EXHIBIT WILL BE OPEN:

Monday, March 15
9 A. M. to 6:30 P. M.

Tuesday, March 16
9 A. M. to 10 P. M.

Wednesday, March 17
9 A. M. to 6:30 P. M.

Thursday, March 18
9 A. M. to 3 P. M.

The National Railway Appliances Association will present its 26th Exhibit at the Coliseum, in Chicago, on March 15 to 18, 1937, concurrently with the conventions of the American Railway Engineering Association and the Signal Section, Association of American Railroads.

This Exhibit will embrace the most comprehensive display of materials, equipment and tools employed in the construction and maintenance of railway track, bridge, building, water service and signaling facilities assembled under one roof in years. You will find in it much of help to you in meeting today's requirements. It is a *practical* exhibit for *practical* men.

When attending the convention, make it a point to VISIT THE EXHIBIT and investigate the many improvements that have been made during recent years.

NATIONAL RAILWAY APPLIANCES ASSOCIATION
208 SOUTH LA SALLE STREET CHICAGO, ILLINOIS

Railway Engineering and Maintenance

Floods

Emphasize Importance of Railway Service

NOT infrequently it requires a major crisis to bring about a proper realization of our dependence on agencies whose presence and continued existence we have long taken for granted. Equally important, such crises also frequently bring out fundamental shortcomings of other agencies whose activities in fair weather tend to undermine the security of those agencies whose existence is shown to be so essential. Such a condition exists with reference to the railways and their competitors on the highways, on the waterways and in the air.

Flood Creates Crisis

The relative importance of these various transportation agencies to communities in distress was shown in a striking way during the last month when cities along the Ohio river were visited by a flood of greater height than ever before experienced. In this flood, which assumed serious proportions on the upper Ohio the middle of January, and which did not pass into the Mississippi until a month later, Portsmouth, Cincinnati, Louisville, Paducah and Cairo, not to mention many smaller intermediate communities, were confronted with river stages exceeding all previous records and large parts of these cities, except Cairo, were submerged.

This flood created most serious problems for the railways, for their terminals were submerged, thousands of cars marooned and lading damaged or destroyed, roadbeds softened and washed out and operation suspended on many important through routes for weeks, with losses running into the millions of dollars. But it was not with these losses, serious though they were, that the railways were most concerned. On the contrary, they recognized their responsibility to the striken communities along their lines and gave first attention to the relief of need.

First in Rescue

First, of course, was the rescue of those who were caught by the rising waters. Hundreds of special trains were rushed into the flooded areas, carrying relief workers, boats and other equipment for rescue operations. Dozens of Coast Guard squads, with their boats and other equipment, were moved in from stations on the Atlantic Coast and the Great Lakes. Two contingents of officers and men with boats, radio and general equipment were sent from the Philadelphia Navy Yard, while one special train carried nearly 200 volunteer seamen from New York to Louiville. By means of the priority given to trains of this character, it was possible to rescue thousands of people who were otherwise without hope of escape and to hold the loss of life to a very small figure.

But once rescued, the problem was only begun. As the waters rose to unexpected heights, it became necessary to evacuate entire cities and to transport the people to places of safety. No record will ever be compiled of the actual number of refugees handled by the railways as no effort was made to collect tickets, but it is estimated that they carried more than 200,000 persons to safety. At Louisville, for example, shuttle trains carried more than 50,000 persons to points adjacent in Kentucky, while at least an equal number were transported to points in Indiana and elsewhere, where shelter and food were available.

Handling the Sick

Equally heroic measures were taken by the railways to co-operate with public health authorities in caring for the sick. In numerous instances lounge cars were stripped of their furnishings and fitted up as hospital cars for the movement of the sick. In one instance an entire hospital staff, together with patients—some in critical condition—were transferred from a hospital in the danger zone to another beyond the flooded area. In another instance a complete United States field hospital with ambulances and full equipment was rushed from Carlisle, Pa., to Louisville. During this period train after train was sent into the flooded areas, carrying without charge supplies shipped by the Red Cross for sufferers in these areas, including not only medicines but also food, clothing, blankets, cooking utensils and other supplies needed by the refugees.

Because of the contamination of drinking water, the railways collected and sterilized hundreds of tank cars which were then used to haul drinking water into Cincinnati, Evansville, Louisville and other stricken communities. In one instance a special train of 50 tank cars was given preferred movement all the way from Philadelphia to Indianapolis to meet this demand. Locomotive tenders were also used, after being sterilized, for the transportation of drinking water supplies to many communities.

Again, the railways provided housing for thousands of refugees—turning over Pullman cars, day coaches and box cars until other quarters could be found. To provide for a further evacuation of residents along the lower Mississippi river, if the necessity should arise but which

fortunately did not materialize, the Car Service division of the Association of American Railroads moved 700 empty cars from the North Atlantic Seaboard into this area by special trains, while the roads of the southeast rushed 1000 more into the same area.

Employees Co-operated

And these services were rendered by employees who continued to operate rescue trains long after the tracks were submerged, until the water threatened to extinguish the fires in the locomotives. In many cases they remained at their posts of duty when their own homes were being endangered and their families evacuated. In Louisville, where the general office building of the Louisville & Nashville railway was surrounded by water and was without heat, and part of the time without lights, six girl telephone operators remained continuously on duty for nearly five days to provide contact between the mayor's relief committee and the railway's officers, and in this period made more than 1000 such contacts. In another instance, the railway lost all contact with one of its bridge gangs for several days, finally receiving a radio message from Red Cross authorities advising of the safety of the men and commending them most highly for their work of rescue. Such records received little attention in the newspapers; yet they could be repeated hundreds of times. They are characteristic of that highly disciplined corps of employees who comprise the staffs of the railways.

In addition to the burdens that were thrust upon the railways within the limits of the flooded areas, when every gateway across the Ohio below Steubenville, Ohio, was closed, serious disruption to traffic occurred that reached far back from the areas inundated, causing inconvenience to many people and hardship to many industries and communities that were cut off from their normal sources of supply. To reroute this traffic over other lines added greatly to the confusion and congestion; yet the railways accepted it, as they did the relief work in the devastated areas, as a responsibility that was not to be evaded.

Not to be Forgotten

In these and other ways the railways arose to the emergency in the way that has long been characteristic of them—and yet in a way that no other transportation agency can equal. The record which they made is one which these communities cannot soon forget. It is one which railway employees elsewhere should so publicise that the lesson will be brought home as well to those living in communities remote from this disaster in order that they may foster the railways that now serve them in preparation for the day when they may themselves face a similar crisis.

Field Service

No Longer a Source of Controversy

SOME years ago one of the most thought-provoking articles in the March Equipment Economies Issue of *Railway Engineering and Maintenance* cited case after case of unreasonable demands made by the railways for the assistance of manufacturers' field men in the servicing of power appliances. It was not unusual, as pointed out in this article, for service men to travel 500 miles in response to calls, only to find that some one had failed to detect a broken wire in an ignition circuit. At about the same time the railroad manager of another supply company declared that his greatest source of worry was machines of his company standing idle along the right of way of railroads that were his best customers. The purchasers were satisfied with the machines but saw no reason why they must be kept at work every day.

Considering these facts in the light of what has since transpired, we know that they were but the birth pains that followed the conception of a new idea. The railway officers who pioneered in the introduction of mechanical appliances deserve a great deal of credit for their enterprise and courage, but it is doubtful if either they or the managements that authorized the necessary expenditures had any conception of the problems of administration that would fall to their lot as a result of this new development.

Without question the most important oversight was the failure to realize the necessity for a thoroughly organized plan for the maintenance of this new equipment. But this is not at all surprising because the manufacturers, in their zeal to get their appliances introduced, not only depreciated the magnitude of this problem but also assumed responsibility for most of the repairs themselves. The first units of equipment were experimental at best and needed considerable field attention that the builder was obligated to give them, and as time went on he had to continue this service because the railroads were not organized to take it over.

As a consequence, the demands of the railroads for service from the manufacturers became a severe burden. While these manufacturers realized that this situation would continue until the railroads organized to handle the upkeep of the machines, they were not in a position to call attention to this shortcoming of their customers.

Lack of centralized control to meet the needs imposed by the introduction of power appliances was manifested also in a low use factor; the machines were idle too much of the time. And it was not until the investment in equipment ran into large figures that the need for adequate utilization to insure a return on the investment became a matter of real concern. Since a machine that is out of repair fails to earn its return just as surely as one that stands idle for any other reason, effective means of upkeep is an important element in any plan to insure adequate use.

Eventually many of the railways have come to realize that maximum utilization, effective operation and adequate maintenance of work equipment demand a degree of supervision that cannot be exercised by division and subdivision officers unaided, because their attention is necessarily directed primarily to the business of getting work done. As a result, many railways have created

special staffs to instruct operators, assign the machines and see that they are kept in condition for use. The article beginning on page 162 of this issue describes the methods and organization employed by two railroads.

As a result of this development the administration of power equipment has been so greatly improved that, as will be noted in the article on field service, beginning on page 188, the relations between the railroads and the manufacturers in this regard is now fraught with fewer occasions for controversy, although, there is still room for improvement.

Effective Use

Makes Difference Between Profit and Loss

NO PROBLEM connected with work equipment approaches in importance that of keeping it busy. Ownership requires an investment which represents a loss unless the equipment produces a return commensurate with its cost. To do this it must be kept at work a sufficient time not only to accumulate savings equal to the carrying charges, but enough more to produce a profit. Obviously, a profit cannot reasonably be expected from a unit whose operation is ineffective or subject to frequent interruption, particularly if the progress of a large gang depends on its continuous and effective operation.

These considerations have indicated to maintenance officers the importance of keeping work equipment in good repair at all times, to insure that it will be available for continuous service and capable of maximum output throughout the working season. The best system of assigning and supervising its use; thorough co-ordination of the size and activities of the gang to which it is assigned, to produce maximum output; and careful planning of the season's schedule, may all be nullified by an ineffective system of inspection and repair.

To insure both maximum and effective use of this equipment, different roads have developed different methods of meeting the problem of equipment maintenance. They fall into two general groups, the fundamental difference being that in one case the maintenance-of-way department is in charge of and makes all repairs with its own forces, while in the other group the mechanical department provides the facilities for making the repairs and does the work with its forces. There are many differences in the details of the methods followed by each of these two groups, such as system, regional or local headquarters for making the repairs, and the manner in which the current inspection and maintenance are performed.

Two articles which appear in this issue describe the practices on roads which are representative of the two groups, and on which the differences between the two methods are clear cut. On the Illinois Central, the entire responsibility for operating and maintaining work equipment, except M.C.B. units, lies in the maintenance-of-way department which provides the facilities and the force for making the repairs. Incidentally, on this road the work is organized on a division basis, with a well-equipped shop on every division.

In contrast to this practice, on the Pennsylvania the mechanical department does all of the shop work, in collaboration with the maintenance department which provides the force for field repairs. To emphasize more sharply the difference between the practices of these two roads which typify the fundamental groupings, the repair work on the Pennsylvania is concentrated in two large shops to which all units are sent when in need of attention.

Both of these roads are larger users of work equipment, and both of them maintain it to high standards, with a view to making their investments in this equipment as highly productive as possible. It is of interest, therefore, to consider the divergent manner in which they have approached the same problem.

The Future

Is There a Field for More Power Tools?

PROPHECY is always dangerous; it is especially so in these days of such rapid change in every industry, and especially in transportation. Ten years ago no one foresaw the stimulation in passenger travel that would come from greatly accelerated speeds and air-conditioning,—yet they have gained widespread acceptance today.

An effort to predict the developments of the future in maintenance of way and structures is fraught with equal hazards. Apparent trends are so easily upset by subsequent developments. Thus, the rerolling of worn rails received a severe setback with the expanded use of the cold saw for end cropping, and both rerolling and end sawing were eclipsed by the perfection of processes for rail-end welding. Fifteen years ago no maintenance officer felt any serious need for any form of rail grinder, but because the grinder was a requisite for the satisfactory finishing of rail-end welds, a new tool has been perfected and with it a demand for refinement in rail surface that was formerly deemed unnecessary. Once the surface grinder was recognized as a track appliance, it was but one step farther to the cross grinder.

Fifteen years ago efforts to mechanize the construction of wooden bridges were focused on the development of portable power saws and drills and the timber dapper. But the widespread adoption of preframing has caused the portable timber dapper to fade out of the picture, while the portable saw and wood borer have become more useful as auxiliaries to the machine tools of the preframing plant or in construction not involving the use of treated wood. In the meantime the track tie adzer has won a place among track appliances that no one could have predicted a decade ago.

In track work the multiplicity of times with which specific operations are repeated provides an ideal setting for mechanical equipment and it has already received widespread reception for many tasks, a striking illustration of which is the complement of devices now provided for the modern rail-laying gang. Yet there are still numerous operations in track work that have as yet defied mechanization, as for illustration the renewal of ties. There is, therefore, still opportunity for further development in power appliances for use on the track, or for changes in practice that will adapt them more readily to performance by mechanical means.

What Is Ahead fo

A survey of the maintenance of way budgets for the current year

THE railways of the United States will spend $50,000,000 to $75,000,000 *more* for the maintenance of their roadway and structures in 1937 than they did in 1936. In other words, their expenditures for this purpose this year will approach the total of $530,612,890 for 1930. In so doing, the roads will continue the increase that has prevailed since the bottom of the depression in 1933. From this level they increased 13 per cent in 1934, 22 per cent in 1935 and 41 per cent in 1936. And these increases are not confined to the railways of the United States, for similar recovery is also reflected in the programs of the Canadian and the Mexican railways. These forecasts are based on information given us by the chief maintenance officers of 37 of the largest railways whose combined mileage aggregates 60 per cent of the total.

Equally significant with these figures is the change in the attitude of railway maintenance officers towards expenditures. A few years ago, when the exigencies of depleted revenues were requiring them to pare their budgets to unprecedented minimums, they were inclined to minimize the accumulation of deferred maintenance as a factor to be considered in determining the needs for greater outlays, contending that the reductions in expenditures were no greater than were warranted by the reductions in wear and tear that had followed the decline in traffic. In contrast with that attitude is the point of view of 34 officers who discussed this point in replying to the questionnaire referred to above, of whom only 5 contended that their railways had suffered no appreciable deterioration in condition as a result of curtailed expenditures, and of the five roads represented in these five replies, four are in exceptionally favorable positions with respect to sustained earnings or financial security. The officers replying for all the other roads indicated that they recognize deferred maintenance as a factor that must be given weight in determining future appropriations for the upkeep of their properties.

How Much Will Be Spent?

How much will be spent for maintenance of way and structures in 1937? A fairly accurate measure of the anticipated volume of this year's expenditures is to be had from a survey of the programs now in preparation by individual railroads. Thus, while the officers of 16 of the railways referred to advise that their roads are not now planning to spend more than in 1936, 18 others state just as definitely that their outlays will be larger. Among those in the latter group who were willing to hazard specific estimates as to the percentage of increase, two placed it at 10 per cent, four at 15 per cent, three at 20 per cent, one at 25 per cent, and one at 100 per cent. It is also pertinent to add that several of those who stated that their budgets had not yet been increased, anticipated larger appropriations in the event of a continued increase in traffic throughout the year.

For What Purposes?

What items of maintenance work will receive major attention? From the comments on this question it is evident that track, as always, will receive prior attention. The objective is seen in the statement made by seven officers to the effect that improved riding quality has become a more important requisite of track than ever before. Three of them also referred specifically to greater refinements in curve alinement and super-elevation and one cited studies for contemplated revisions in curvature.

In view of this, it is not surprising that more than half the returns mentioned rail renewals as having a major place in their budgets. This is sub-

ıd for 1937?

Appropriations for maintenance of way and structures during 1937 will be appreciably larger than in 1936. More money will be spent on the tracks—much of it for material replacements that have long been deferred, to the end that a high standard of line and surface may be obtained with lower outlays for upkeep. The budgets have been expanded sufficiently to permit of larger allotments also for bridges, buildings and other items that suffered the most serious neglect during the depression.

stantiated by the large volume of rail orders placed since the first of October, 1936. These roads and several others also mention other track materials, rail-end reconditioning and joint-bar renewals as having major places on their programs. One road is planning to butt-weld a considerable amount of new rail.

Second in importance only to rail renewals, according to the information received, come ballasting and surfacing. Tie renewals occupy an important place in the budget every year, but because they did not suffer as great a decline during the depression as most other elements of track maintenance, they will not be increased this year to the extent that other phases of the program will be expanded. There are, of course, exceptions to this rule, as will be noted elsewhere.

Expenditures on the track normally represent about three-fourths of the total outlays for maintenance of way and structures, exclusive of such undistributed items of superintendence, tools and equipment, injuries and miscellaneous. Consequently, while the appropriations for work on bridges, buildings and other units of the fixed properties, other than track, do not compare in magnitude with those for the major track items, as reported by several of the roads, they do show especially large increases when compared with those of the years immediately preceding.

Deferred Maintenance

As stated previously, only five of the replies received to the questionnaire reported in effect that there had been no accumulation of deferred maintenance as a consequence of inadequate expenditures during the depression. Several other replies expressed the view that expenditures had been reduced in proportion to the decline in revenues, but were not explicit as to whether these reductions applied to such items of property as bridges and buildings, the deterioration of which is affected but little by variations in the volume of traffic. A more typical reply was that the funds available had been devoted to keeping the tracks and bridges in safe condition for operation. One road which has made a detailed study of its deficiencies in expenditures for maintenance of way and structures to the end of 1935, concluded that this deficiency then approximated half the actual expenditures of that year.

Insofar as the track alone is concerned, the comments on deferred work embraced substantially all of the principal items. One officer mentioned "ballasting, ties and ditching," another listed "ties and rails," while others referred to "clearing the right of way," "rails, ties and ditching," "bank widening and ditching," etc.

One officer referred to the reductions in expenditures effected by decreasing or eliminating altogether the maintenance of tracks and bridges that were taken out of service or on which traffic was greatly reduced. Two others stated that expenditures on branch lines were reduced below levels that insured normal upkeep, in efforts to provide adequate maintenance on main lines. Still another practice to which attention was directed was that of concentrating efforts on repair rather than replacement work with the object of reducing renewals to a minimum. Rail-end welding and the repair of frogs and other trackwork by welding were mentioned especially in this connection.

While all of the replies to our inquiries concerning deferred maintenance were insistent that curtailment of expenditures had not resulted in any decline in the standards of upkeep of either tracks or structures, insofar as they affect safety of operation, a number of them admitted the lower-

ing of standards in other respects. This was best expressed in the statement of one officer that "Our property has been maintained in a normal manner in all respects except painting and other items involving appearance only."

The inadequacy of painting programs during the depression was commented on by many of the officers. Several referred also to deferred building repairs, and one to the need of tank renewals. As one officer expressed it, "the painting of buildings was practically eliminated during the period of retrenchment and so also were repairs to buildings, except those made necessary by safety requirements."

Last Year's Work

Further information on the present status of the properties with respect to deferred maintenance and the nature of the deficiencies is afforded by the comments made by railway officers concerning the expansion of their maintenance programs in 1936. On a few of the roads the rehabilitation work was started somewhat earlier, as indicated by the following statement:

"Beginning in 1934 we started an improvement program, and since then have laid 130 miles of new 112 lb. rail, added a lot of new ballast, relined a majority of our curves, replaced some of our weakest bridges, and made improvements in our signaling, so that I now feel that we have more than recovered what we lost during the depression, and our railroad is, today, in better condition than it ever has been."

Another, in much the same vein, stated that "Decided progress was made in 1935 and 1936 in bringing our principal main lines back to the best possible riding condition until these lines are now in better riding condition and the general line and surface is better than ever before." Still another officer states that "we did not accumulate any large amount of deferred maintenance during the depression and what there was will be wiped out this year. This involves some increased tie renewals, ballast work, etc."

With equal frankness, one road reports that only 23 per cent of its accumulated deficiency was made good in 1936. Still another road, which expanded its program in 1936, is working to a plan covering a period of four more years in which the expenditures will approximate those of last year.

Not so sanguine is one comment that "little, if any, progress was made during 1936 in respect to absorbing accumulated depreciation," while another officer states that its "deferred maintenance has been mainly in rail, ties, bridge and building repair work and ditching."

Four officers refer particularly to the status of painting. One states that "some progress was made last year in painting steel structures, and improving the general condition of structures." Another advises that "the only item of maintenance that has been definitely below our pre-depression standard is painting and considerable progress was made last year in catching up with this. A third reports that "bridge painting covering probably 60 per cent of our bridges was taken care of last year," while a fourth states that "while we have been doing some painting all along, last year was the first year in which we have carried out a heavy painting program since the depression."

One road reported in considerable detail on the improvement which it made in its track last year. "During 1936," it advised, "considerable recovery was effected in maintenance over the depression years of 1931 to 1934, inclusive. Our rail-laying program in 1936 included 451 miles, as compared with 111 miles in 1935 and 137 miles in 1934. Tie renewals in 1936 were 165 per main track mile, as compared with an average of 129 for the years 1930 to 1934. Our 1936 weed killing expenditures increased approximately 100 per cent over the period from 1931 to 1934. Our rail-end and frog-welding program for 1936 also showed a large increase, as compared with previous depression years." Another comment relating to tie renewals is that "starting in 1935 and more decidedly in 1936, our tie standards were raised and are now practically normal."

What of 1937?

In what direction will maintenance programs be expanded in 1937? Perhaps the most pertinent answer to this question is the following: "In our maintenance program we are not giving any factor preferred attention, unless it is that of maintaining the highest possible standard of line and surface and, of course, emphasizing most emphatically the necessity of maintaining our track structure to the strength requisite for speeds at which traffic is being handled."

While not mentioned by others, it is apparent that this objective was a primary one in formulating the budgets of other roads, as is indicated by the fact that most of the replies listed rail renewals, ballasting and surfacing as among the items of their budgets that are being expanded most largely. Tie renewals are also mentioned by several roads. One of them reports that it is for the first time adzing, boring and incising all of its treated ties. Another road reports an increase of 22 per cent in its tie renewal program, this increase to be confined largely to main lines, and to branch lines on which tie renewals have been somewhat neglected but on which traffic has increased substantially.

Among other roadway items mentioned are roadbed widening, drainage, ditching and weed eradication. Two of the eastern railways report an accumulation of deferred ballast cleaning, and state that efforts will be made to overcome at least a part of this deficiency during 1937. A western road makes special reference to a larger fencing program.

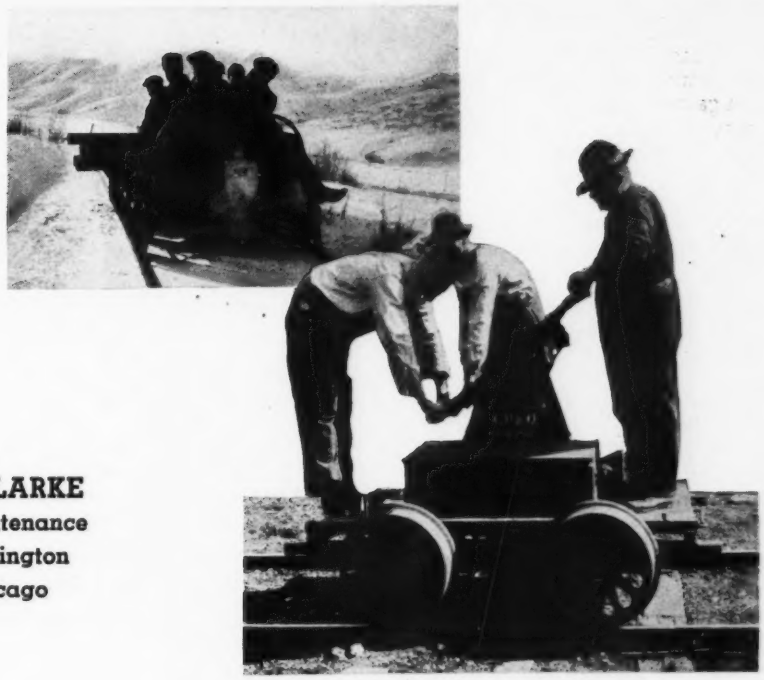
While mention is made of a larger amount of work on bridges and buildings, the one item that is referred to most frequently is painting, the need for which is obvious from the frequent references made to the deficiency in this phase of the maintenance of structures. One road specifically lists a budget item of $150,000 for painting, adding that it comprises "a large increase over previous years."

Obviously, no two roads present exactly the same picture; financial and physical conditions are subject to too wide variations. It is impossible, therefore, to generalize concerning their needs or their programs. However, the following tabulation submitted by one road, while it can by no means be assumed to represent average conditions, is of interest as indicating how the budget has been expanded on a particular road:

Major increases in operating expenses, 1937 over 1936

	Increase, Per Cent
Track laying and surfacing	19
Roadway maintenance	9
Tunnels and subways	40
Bridges, trestles and culverts	8
Cross ties	21
Rails and other track materials	15
Ballast	75
Stations and office buildings	43
Shops and enginehouses	22
Signals and interlockers	20

In conclusion, it is clear that expenditures for maintenance of way and structures will be appreciably greater during the current year, and that while they will be directed, as in the last few years, to those activities which are of paramount importance for the safe and effective movement of trains at accelerated speeds, the budgets have been expanded sufficiently to permit of material increases in the allotments to those other items of upkeep which have suffered the most serious neglect during the depression.



One Dream that Has Come True

By H. R. CLARKE
Engineer Maintenance of Way, Burlington Lines, Chicago

Are We Out of the "Hand-Car Era"?

PRACTICALLY every man responsible for the maintenance of roadway and track, whether he be a laborer or chief engineer, will contend that his task is more difficult than it was for his predecessor of a few years ago, for he thinks of the speed at which all traffic, freight as well as passenger, is moving today, and knows the insistent demand that the most critical passenger shall experience no sense of discomfort, even at the highest speeds now operated. Yet he is not oblivious to the changes and improvements in tools, material and methods that have made it possible for him to do his part in meeting these demands. Wider roadbeds that are more solid and more thoroughly drained, ballast of a better and more lasting quality, treated ties, large tie plates, rail anchors, heavier rail of improved design and better steel are all contributing their part.

To the average passenger and to the public in general, there seems to be little change in the track of today as compared with that of some years ago; yet to the experienced maintenance man there has been a decided improvement. Tools have also been improved. The shovel, the spike maul and the claw bar that the trackman uses today may look very much like the tools he used some years ago, but they are better tools. The material is of a higher grade, it is heat treated, and the design has been so markedly improved that the tool of today is far better adapted to its purpose and is far safer to use.

The last two decades have witnessed the development of many machines for maintenance of way operations. Device after device has been perfected to eliminate drudgery, to increase efficiency, until today the investment in work equipment runs into millions of dollars.

Has the limit been reached? Are there tasks still unaided? Is there equipment demanding further development? In this article, Mr. Clark reviews the progress that has been made to date and points to some of the possibilities of the future.

The development of work equipment is more readily recognized Equipment has been designed and built to help the maintenance man in his tasks and he has been prompt to utilize it. It was not so many years ago that "work equipment," as applied to the maintenance of way department, was understood to mean large steam shovels, lidgerwoods and plows, cumbersome wooden spreaders and pile drivers propelled by locomotives. Derricks or clamshells had been developed but they were usually confined to material yards and were seldom found out on the line.

Now the steam shovel has almost disappeared. Air dump cars have replaced the flat cars, with their lidgerwoods and plows. The steel spreader is almost automatic in its adjustments. The pile driver is a high-speed, self-propelled unit. Cranes, derricks and

clamshells are in very general use and they also are high-speed, self-propelled units. In fact, one of the most versatile and effective units of equipment today is a gasoline-powered, full-revolving crane of medium capacity.

One of the interesting developments of late has been the gradual replacement of steam with gasoline-powered units and in a few instances with Diesel engines. The tendency away from steam has been most noticeable in the smaller units.

Reducing Hand Work

Some years ago work equipment was employed only for the heavier work that could not be done by man power, such as driving piles, handling dirt in large quantities, etc., and the only equipment that was available was designed for such work. Today conditions are different, for equipment has been designed and built to do much of the work that was formerly done by hand, or at least to lighten the drudgery and make possible better work. On all progressive roads, light cranes have replaced tong men, power adzers have supplemented hand adzing, and bolt-tightening machines have superseded wrenches, all making possible more uniform and accurate work.

Tamping equipment, of either pneumatic or electrical design, is in general use and it has been so improved that units are available in a variety of sizes to fit the work being done and the force employed. The back-breaking tamping pick has been replaced by a tool that not only lightens the labor but also does a much better job of tamping under many conditions than even the most competent workman could do by hand power. Tamping tools have been so improved that more work can be done with less power and manufacturers have recognized the need for keeping the track free of obstructions by building lighter power plants or mounting the power plants so that they may be moved along the shoulder clear of traffic.

The power jack that is in use today is a step in advance of even the most efficient hand-operated jack, especially where track is being raised very much, as on a grade-raising or a heavy reballasting job. It is not easy to think of such work being done with the old time "lifting pole."

The use of power tools in bridge and building work is general. Power saws of various sizes and kinds, drills, wrenches, hoists, etc., driven by either air or electricity, have greatly expedited bridge work. Concrete mixers are now gasoline-powered and are usually smaller and much more easily handled than those of a few years ago. The improvement in pumps has been equally marked. It is no longer necessary to unload a huge boiler with a derrick and set up a steam plant to operate a slow and inefficient pump. Instead, we now have compact gasoline-powered pumps, easily moved, that will throw more water.

The perfecting of the art of electric welding and the building of portable power plants and generators have changed the methods and practices of steel bridge work very decidedly. Probably no money can be expended that will bring a larger return than that spent in the welding of battered rail ends, frogs and switches. Opinions differ as to the relative merits of the oxy-acetylene and electric methods, but there is no difference regarding the value of welding by either process when properly done.

The "Hand Car Era"

The term "horse and buggy days" has been used to denote lack of progress and vision. We might use the term "hand car era" in the same sense. Both now seem to be characteristic of the past and in the latter case at least this is for the better. Mechanical power has replaced man power and track motor cars are almost universally used to transport men in the maintenance of way department. This is a comparatively recent development, for many men are still active in maintenance of way work who well remember the back-breaking hand car and velocipede. However, even if new, the development has been rapid. The motor car of today is a reliable, dependable aid. Cars have been developed to fit varied needs, from large, two-speed, heavy-duty cars required for pulling heavy loads or handling large gangs of men on trailers, to the light, compact inspection car for one or two men, with almost all gradations in between. Probably the average maintenance man, if asked which labor-saving device he would give up last, would select the motor car.

"Off-Track" Equipment

The "caterpillar crawler," or "endless track," has made possible the construction of equipment whose radius of operations is not confined to railway track. Machines so mounted and operating as cranes, clamshells, draglines or shovels are used extensively in handling dirt, cinders, gravel and other materials. Equipped with leads and a hammer, they are efficient pile drivers, particularly in driving foundation piles or sheet piling. In these varied applications, they possess the great advantage that they do not obstruct track. Increased speeds, shortened schedules and other operating conditions have increased the advantage of machines which can be used without at any time obstructing the track, and this consideration is becoming more important daily.

I have touched on only a part of the developments in materials and equipment that have helped and are helping those of us who are in the maintenance of way department to do our work efficiently. Many other types of equipment might be listed, such as weed burners, weed mowers, flange oilers, etc., but those mentioned indicate the progress that has been made. As we review what has been done, the questions arise, "What is yet needed?" "What more does the maintenance man require to help him keep up his end?" I find these questions difficult to answer.

The small tools used in maintenance of way work have been developed until they are well adapted to their purpose and their quality has been improved. The problem here is largely one of continual study to im-

Crawler Mounted Equipment Takes Work off the Rails

prove quality further without undue increase in cost. In the larger tools and work equipment there is still opportunity for the development of units not yet available, or at least not generally considered successful, as well as for the improvement of equipment now in general use and accepted as at least fairly satisfactory.

The faster schedules in both passenger and freight service emphasize the need for avoiding all possible interference with traffic. This and other reasons that are possibly even harder to control, increase the necessity for developing equipment that can work in the clear and not obstruct the track, or that can be removed from the track so easily and quickly that it cannot be considered an obstruction to traffic.

Steady Improvement Has Been Made in the Equipment Used

The use of equipment on crawler treads has been mentioned. The increased use of this type of machines should be possible and study of this possibility is justified. One objection to crawler tread equipment in many services is its slow travel speed. This should be increased and the equipment made more mobile. Suitable equipment so mounted might be used with trucks in ditching and bank widening work and so eliminate the train service that is now required, with a resulting reduction in costs.

Machine for Renewing Ties

A satisfactory machine for renewing ties has not yet been developed. As this work consumes so large a part of the time of the track forces,e such equipment should find ready acceptance, but to be accepted it must save time and reduce cost, as well as do good work.

The driving of spikes in both tie renewal and rail relay operations is still largely a hand operation, as the machines for this purpose that are now on the market are cumbersome, so that little, if any, saving is realized by the use of the machines. A self-contained unit that would eliminate all hand work and do a better job at less cost would be of value, especially in connection with rail relay work.

Spike Pullers

There are machines on the market that will pull spikes, including at least one self-contained unit, but they have not been generally adopted as the savings that they can effect is small at best. Further improvement in this while the spikes must be set by hand, equipment should be possible and if real savings can be realized, such machines should find ready acceptance.

Steady improvement has been made and is still being made in nearly all equipment that is now widely used and considered fairly satisfactory. This should and will continue, principally along the lines of making such equipment lighter, more mobile and more generally adaptable without sacrificing strength or increasing costs too greatly. The track motor car is a striking example of what has been done. The improvement in it in the last few years compares favorably with progress in automobile design and the manufacturers are not yet resting on their laurels.

I have mentioned acetylene and electric welding as being of great value for both track and bridge work. Here, too, there is room for further improvement and the supply industry and the railroads should carry on joint research to improve methods and technique. This is especially desirable in the welding of manganese frogs, crossings, etc.

I do not favor attempts to develop "jack of all trades" equipment. On small roads with limited equipment, such machines are of value, but on the larger roads, and this includes the larger part of the important railroad mileage, there is generally sufficient work to warrant a machine designed for a specific job, and such a machine will almost certainly be more efficient than one that is designed for a variety of work. Flexibility and adaptability are desirable, but they should not be provided at the expense of efficiency and costs should not be increased too greatly in the effort to secure them. Here again the railroads and the manufacturers should work together to produce the equipment that will be most efficient in the work for which it is intended and then find such other places where the use of the machine will be justified. Here the free exchange of experience through the technical press of the railway maintenance field is of great value in stimulating ideas and developing new uses to which equipment can be properly adapted.

A Measuring Stick

A number of years ago I prepared a statement or list of requirements as a guide for myself in recommending purchases. To justify the expenditure for purchase and the expense of operation, work equipment must do one of four things:

1—Perform a given task more economically than it can be done by manual labor.

2—Do a job better than it can be done by manual labor.

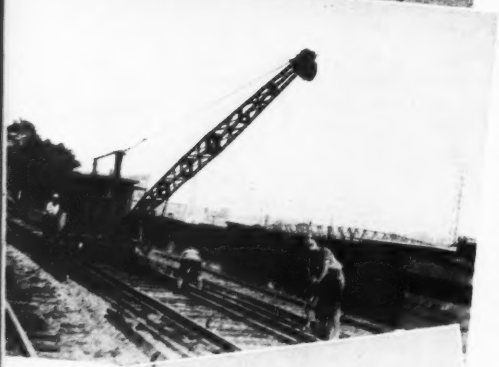
3—Do work which cannot be done at all by manual labor.

4—Do work for the accomplishment of which it is not possible to secure manual labor.

If a machine definitely fulfills one of these requirements it will likely be used generally; if it meets two or more of these requirements, its almost universal use is certain. Conversely, machines now available, more or less fully developed, have not been accepted because they do not fulfill any one of the conditions listed sufficiently to justify their use.

At present, the fourth requirement which I have outlined has little weight as there has been no scarcity of labor in recent years, but this condition may not always prevail. Varying conditions, such as changes in wages or in the efficiency of labor, may affect the first two requirements, but even though they may be modified to some extent, the four requirements listed will continue to afford a measure for placing a value on equipment. Maintenance officers are generally insistent in demanding that equipment be justified economically if they are to look with favor on its use.

Is There a Shortage of



WITH railway earnings rising steadily for 18 months, and with a corresponding increase in appropriations for maintenance, it is pertinent to determine what effect this trend is having on expenditures for work equipment. Is it changing the attitude of maintenance officers with respect to the condition of this equipment? To retaining in service units that require excessive maintenance? To the continued use of machines that have become obsolete? In brief, how nearly does the work equipment now on the railways meet the needs of the maintenance forces, especially in view of their enlarging programs?

These questions, among others, were asked of the chief engineers and engineers maintenance of way of the larger railways of the United States and Canada, who were invited to join in a study of the present situation with respect to work equipment. Replies were received from officers in charge of the maintenance of 176,000 miles of lines, or 59 per cent of the total mileage operated in these two countries.

The importance of these questions will be understood more readily if we review briefly the events of the last eight years. In 1929 and the years immediately prior thereto, both construction and maintenance programs were large and the railways were buying a great deal of work equipment. Yet few railways had enough machines of any types to meet their needs, and the engineering officers on many lines were often at their wits ends to assign the units they had available in such a way as to keep all of their work going to best advantage, with the result that they were asking for additional equipment of many types.

Almost overnight the situation changed and the widespread retrenchment in programs which followed the market collapse of 1929, converted the shortage into a surplus of almost every class of equipment. This surplus was further increased on numerous roads in the case of motor cars and a few other types of equipment, through the reorganization of track forces and the reduction in the number of gangs. Furthermore, as earnings shrank, the railways quit buying everything except essential items.

As a result, up to last year, the railways purchased practically no work equipment for seven years, while many of the units they had owned at the beginning of 1930 had been used so intensively during the depression that they were wearing out and requiring excessive repairs to keep them in service. It was so difficult to secure the repair parts needed for this purpose, however, that in many cases the surplus units that had been stored were robbed of parts to make the necessary repairs to the active units. For these reasons, at the beginning of 1936, much of the existing equipment was practically dismantled, or was worn out or hopelessly out of date.

With the enlargement of maintenance programs and the prospect of still further increases as earnings continue to improve, knowledge of the present situation with respect to work equipment on all of the roads becomes of prime importance to the officers of individual roads. For this reason a number of the larger roads joined in a study of this subject, the results of which show that there is a shortage in almost every type of work equipment and that many of the units now in service are worn out or obsolete.

This situation with respect to work equipment was complicated further by the fact that during the period in question marked changes had been occurring in the methods under which maintenance work was being done. Section gangs on many roads had been reduced practically to policing units and such routine maintenance as surfacing, renewing ties, etc., was

ge of Work Equipment?

beginning to be performed by large gangs organized specifically for such work. Even so simple a task as keeping bolts tight has been turned over to special forces equipped with power wrenches, on many roads.

New Equipment Developed

To complicate the status of work equipment still more, while many units were being worn out or were becoming obsolete during this seven year period, a number of new types of equipment were being developed, of which adzers and self-contained spike pullers are examples. Again, certain other types which had appeared on the market, but which had been used to only a minor extent up to 1930, had undergone further development and had come into much wider favor, even though purchases had been restricted. This latter class of equipment is illustrated by the tractor with its numerous useful attachments, by paint-spraying machines and by crawler-mounted shovels, draglines and cranes.

New practices have also been developed or expanded greatly during the depression, which have had a profound effect on certain phases of the work equipment situation. An example is welding. While the building up of rail ends was not new in 1930, the need for extending the life of rail became so pressing subsequent to that date that the practice was expanded far beyond anything that might have been expected in the normal course of events. The result has been an almost complete turnover in welding equipment and practices, so that both equipment and methods which were then strictly up-to-date are now completely obsolete. The hardening of rail ends by heat treatment and the use of independent fastenings for tie plates are examples of practices that are entirely new since 1930, which have also affected the situation with respect to work equipment.

Thus at the beginning of 1936, maintenance officers on many roads were faced on the one hand with the prospect that they would be able to increase their maintenance activities and on the other with the problem of providing work equipment with which to do it. Yet, a surprisingly large number of these officers believed that they had enough equipment on hand to meet all of the demands their prospective forces would make on it. Fortunately, by comparison at least, work equipment budgets, as approved, were fairly liberal, a surprisingly large number of units being bought during the year in view of the restrictions on purchases up to that time.

Condition of Equipment

As still further increases in maintenance programs are in prospect for this year, it is obvious that the amount and condition of the equipment available for service become of first importance to those officers who are responsible for carrying out these programs adequately and economically. If they are short of machines, either because they do not have what they need or because those they have are worn out, it is obvious that they cannot carry on their work with the same effectiveness or economy as if they possessed enough units in good condition of the types best suited for the work they have to do.

In previous years, questions relating to the condition of equipment have brought out a variety of answers. This year, the officers who furnished the information used in making the study did so frankly and without reservations. The greater uniformity of the replies is also noticeable, indicating that in general and so far as individual roads are concerned, these officers are taking a more hopeful attitude.

A few officers reported that all of their equipment is in first-class condition or will be before the opening of the working season, by which time overhauling will be completed. Others stated that those of their units that are fit for service range from fair to first-class condition and that the remainder are idle awaiting retirement.

A still larger number of roads reported that all of their modern units are in first-class condition, but that the older equipment which they have been compelled to retain in service until it can be replaced is costing too much to keep it in repair.

Most of the officers who stated that their work equipment is in first-class condition excepted motor cars from this category. In fact, it was the practically unanimous report that motor cars are costing too much to maintain and that all or most of this equipment is obsolete because of age or because it is not suited to present requirements. Another and still larger group stated that from 25 to 90 per cent of the remaining equipment on their respective roads is in first-class condition and that from 10 to 75 per cent is now requiring excessive maintenance and should be replaced. This group also stated that from 6 to 20 per cent of the units now in service should be retired because they are obsolete.

The foregoing outline refers to active units—those that have been in actual service during the past year. In addition, not a few officers included lists of equipment which is still being carried in the accounts, but which is either worn out or obsolete. Several also mentioned items of obsolete equipment which are being held for use in emergencies in preference to retiring them.

Is There a Shortage?

While a knowledge of the condition and availability of existing equipment is important if one is to be informed on the work equipment situation, reliable information as to whether there is enough equipment on hand to meet the demands of expanding programs is equally important. In other words, it is important to know whether there is a shortage of work equipment and, if so, how extensive it is. For this reason, specific information on this point was requested.

A few officers advised that they now have all of the machines that they can possibly use and that, since they are keeping them in good repair, replacements will not be necessary in the near future. A few others who also stated that they now have as many units of every type now available as they can use, said that replacements are being made currently as a certain number of machines wear out or become obsolete each year, but that purchases of additional equipment will be confined to new designs which are not now available.

In contrast to these few, the remainder said frankly that they do not have enough units of most of the types they already possess, in part because they have retired so many or taken them out of active service for reasons already mentioned. While the need for practically every type of work equipment was expressed, these officers listed the newer machines as among their most pressing needs, saying that they have none or, at most, only an inadequate number of these. It was particularly noticeable that whereas in former years relatively few officers made mention of power tools suitable for use by the bridge and building forces, this year all but a few expressed a need for tools of this type, saying that they had included a substantially larger number of these in their budgets than in any previous year.

More by 60 Per Cent

Of the 37 roads participating in this study, 2 did not buy any work equipment last year and 2 more failed to give information as to their purchases, leaving 33 from which detailed information was obtained. Likewise, 2 roads do not expect to make any purchases in 1937, while 8 replied that their budgets are not yet completed and that they were unable even to estimate what equipment they will buy, although some said that they are planning larger purchases than last year. Detailed information as to the equipment that will be bought in 1937 was, therefore, obtained from 27 roads out of the 37 which replied.

Forty-eight different types of equipment were purchased in 1936 by the 33 roads giving this information, while the 27 roads giving information as to their plans for 1937 listed 67 separate types, 19 more than last year. Excluding the 8 roads which have not yet completed their budgets and the 2 which will buy no equipment, the remaining 27 will buy about 60 per cent more units than the 33 roads which reported their 1936 purchases did in that year. Furthermore, the total combined expenditure will be considerably more than 60 per cent greater because of the increased number of the larger units which will be purchased. For individual roads the increased number of units to be obtained in 1937, as compared with 1936, will range from 25 to more than 200 per cent.

Motor cars, including lighter cars for section use, extra gang cars, light inspection cars and inspection coaches headed the list of the larger equipment, with respect to the number of units, the increase as compared with 1936 and the number of roads expressing a need for this equipment. More than half of the officers also expressed a need for trailers, without being specific as to their requirements. The 33 roads purchased 692 motor cars and 1 inspection coach in 1936, while the 27 roads reporting their plans for 1937 already have 1,180 motor cars and 6 inspection coaches authorized. A number said further that it is reasonably certain that the number of motor cars will be increased.

Based on the same grouping of

roads, tie tampers will show an increase from 98 complete outfits in 1936 to 136 in 1937, or 38 more outfits complete with power units and tools, while 24 self-contained tampers are also included in these 1937 budgets. While these roads will buy fewer rail cranes, 11 as compared with 20, the same total number of other machines for use in laying rail, 159, will be purchased, although individually there will be some change as follows: bolters 68 against 90; adzers 45 compared with 38; spike pullers and spike drivers the same, 12 and 18 respectively; and power drills 16 compared with only 1.

Weed-destroying equipment has been used intensively since 1929, with relatively little replacement. As a result, 45 machines were purchased in 1936, while 73, an increase of 28, will be bought in 1937. These will be divided between 14 weed burners compared with 11 in 1936; 17 discers against 8 last year; 1 scarafier in each year; and 41 mowers compared with 25. In addition, 8 roads are planning to obtain mowers for use with tractors in mowing the right of way.

For Bridge and Building Work

In previous surveys of work equipment only occasional mention has been made by maintenance officers of a need for small power tools for bridge and building forces. Last year, however, a surprisingly large number of these tools were purchased, although few officers gave specific information as to the number of each type. One typical road, not included, however, in the 33 which have been mentioned, which had never used such tools prior to 1936, purchased that year 127 units for its bridge and building gangs, made up of two 6-in. and twelve 3-in. power saws; 9 heavy-duty hand power drills; 36 ratchet-type wrenches; 48 wood-boring machines, with 32 in. by $1\frac{3}{16}$ in. bits; 14 ratchet-type 1½-ton chain hoists; 3 concrete mixers on rubber tired wheels, ½-bag capacity; and 3 gasoline-engine-driven centrifugal pumps. In addition, 11 portable generating units were purchased to operate these tools.

Because of the manner in which last year's purchases of these small tools and the prospective purchases for 1937 were reported, it is not possible to make a comparison on the same basis as for other equipment or for all of the roads reporting. However, the limited number of roads reporting the value of their purchases bought $12,600 worth of small tools in 1936, while on the same basis the purchases of these same roads this year will amount to $33,600, or more than 2½ times those of the previous year. As nearly as can be estimated from the information given, the 27 roads under discussion will buy about 4,700 units of these small tools. As a corollary, 31 air compressors and generator units will be purchased to operate these tools, except the centrifugal pumps, 10 of which were listed, which will all be self-contained.

Off Track Equipment

There is an increasing interest in off-track equipment, the need for this type being mentioned by many officers. One reason for this interest was expressed by a chief engineer, who said that "the tendency in recent years for train and engine men to demand the employment of pilot conductors and even full crews on work equipment which we believe does not require the employment of other than maintenance-of-way men, has turned our attention to the use of off-track equipment. The use of crawler mountings is resulting in marked economy in maintenance work, and our experience, which covers tractors, shovels, draglines, cranes, etc., indicates that we could use additional units of these machines to advantage."

During 1936, the 33 roads under discussion purchased 18 crawler-mounted units, wheras the budgets of the 27 reporting for 1937 contain 27 of these machines. The latter includes 4 shovels, 8 draglines, 5 cranes and 9 tractors. Incidentally, all of those who mentioned tractors stated that they expect to include bulldozers, sweepers, front-end loaders and other attachments to widen the range of work which can be done with these units.

That the practice of using independent fastenings for tie plates is increasing is indicated by the fact that 33 tie-boring machines were purchased in 1936 and the same number are scheduled for 1937. That the use of wood screws for this purpose is also increasing is indicated by the fact that whereas no machines for driving them were purchased last year, 10 are listed for 1937.

The shaping of ditches, embankments and shoulders and ballast sections has not received the same attention in recent years that was given to it prior to 1930. As an indication that maintenance officers desire to do more of this work, a number of roads are preparing to modernize their spreaders this year, and 6 spreader ditchers are to be purchased by roads that purchased none last year.

Obviously, it is not possible to discuss in detail every class of equipment, since in large part it would be a repetition of what has already been said. However, of the larger items which have not been mentioned, a substantial number of arc-welding outfits, ballast cars, steam pile hammers, clam-shell and orange-peel buckets and power jacks are included in the 1937 budgets.

As has already been mentioned, the list for 1937 includes 67 types of work equipment, compared with 48 bought in 1936. It is of further interest that, excluding the smaller tools for bridge and building gangs but including the

(Continued on page 208)

Field Service

What Has a Railroad a R to Expect From the

WHAT is legitimate field service? Is it a necessary element in the adaptation of mechanical appliances to maintenance of way work? The answers to these two questions lead but to a third,—How much field service have the railways a right to expect from the manufacturers of the appliances they buy?

Manufacturers point with pride to the work of their field men and contend that the value of this service should be taken into account in any appraisal of what the appliances they sell are worth to the railroads. But they also complain at times of unreasonable demands made on their service departments by some railway officers. On the other hand, railway men sometimes intimate that field service is of as much or more benefit to the manufacturers than to the railroads and that at least in some cases so-called "service" may serve as a cloak for efforts to exert undue influence or foster undue partiality for a particular product.

Clearly, the subject is one that presents more than one side, and with the thought that a full and fair discussion of it will prove of value, field service is presented here, from the standpoint of the manufacturer and from the point of view of the railway officer.

As a Manufacturer Sees It

NO other expression used in business is so greatly overworked as "service to the customer." In fact, I am so tired of hearing it at sales conferences and on other occasions that I avoid its use whenever I can. However, I know of no other term that describes in so few words the "follow up" that the vendor must carry on after he has placed his product in the hands of the user. As a manufacturer of power equipment used on the railroads, I say "must" advisedly because it is only through a continuation of the contact between the manufacturer and the railroad—after an appliance has been purchased—that the transaction will result in real advantage to both parties.

It is true that this business of "service" results in abuses—and I will have more to say of them later—but there are many reasons why it is an essential phase of the relationship between the buyer and the seller. In the first place, the wise manufacturer provides service for his own protection—to insure that his product gets a fair and intelligent trial. By that I do not imply that railway officers are unfair, but, on the contrary, that, owing to their manifold duties and the ramifications of their organizations, they do not always have the opportunity to follow up the appliance when it is delivered and see that it gets off with a good start. As a matter of fact, the railroads have a right to expect us to provide instruction in the use and maintenance of a machine, at least when it is being put to use on a railroad for the first time.

Some manufacturers go much further than that; they see to it that all of their machines are inspected by their service men periodically, regardless of how long they may have been in service. Obviously, there will be differences of opinion as to the need for going that far, but there are some very good reasons why a manufacturer must keep tab on his appliances.

He wants to be sure that they are being used by men who know how to operate them and keep them in working condition; he wants to know also that they are being used on work for which they are suitable and not on work for which they are not intended. He also wants to get such performance and cost data as are to be had legitimately for use in promoting the sale of his product to others. A systematic check-up of this kind is made in the course of routine or periodic visits by the manufacturer's service men. It is something that he does in his own interest; yet it is, after all, an important element of what the railroads get for the money they pay for the appliances they buy.

Field service establishes the contact between the supply company and the actual users that is so essential for a thorough understanding of the product by the man in the field. In the first place, it affords the means of training men in the operation and care of a machine. But further than this, it gives the supply company representatives the opportunity to check improper practices and abuses, and let it be said that they discover plenty of them.

Still more important is the opportunity to learn of criticisms of the appliances from the men on the ground. It happens not infrequently that a roadmaster who has a new machine assigned to his territory finds a defect, or what he believes to be a defect, in it but because he presumes that the engineer maintenance of way is enthusiastic about the device and will resent objections, he is reluctant to find any fault. However, if our man shows up on this roadmaster's territory the complaint will soon be forthcoming.

The alert manufacturer deems it

ad a Right om the Manufacturer?

essential to render service of this kind, but he has a right to complain if the railroads expect an unreasonable amount of service. We are glad to be of assistance in training operators, but don't think that we should be expected to do it all. Naturally, we want to make sure that the men assigned to some new machine that we have just delivered will know how to use it and care for it, but we don't think that it should be our job to train a new set of operators every time the machine is moved to another division or when it is put to work every spring. Nor do we feel that we should be called on to send men out to see that it is in working condition at the outset of the season's work.

Emergency Calls

There is another phase of field service that is just as important and often considerably more costly in terms of the work accomplished. Moreover, it is the type of the service that leads to the greatest abuses. I refer to those activities of our field men that might be grouped under the general head of "trouble shooting." It goes without saying that things will go wrong at times with any equipment, with the result that the men who are using it need some expert help. Such emergencies may arise at any time and we are always glad to be of assistance.

The reason for this attitude is a fundamental one. The manufacturer would rather have the complaints come to him than to have the defects in his equipment talked about behind his back. But that is not all, for while the service man's visit may disclose some unlooked-for defect, it more often brings to light some practice in the use of the machine that precludes effective results in its operation. In other cases the service man finds that it is not being properly maintained or operated. In any event, his presence on the ground enables him to correct the condition responsible for the trouble, and by preparing a report that is sent to the proper officer of the railroad the first step has been taken to avoid a repetition of the trouble.

Of course any supply man can cite cases where his company has been put to unnecessary expense for field service because the railroads' machine operators or maintenance men could have found the trouble themselves if they had (1) read the printed instructions that we furnish with every machine, (2) made a careful check of the appliance and (3) kept it clean enough so that a defect could be seen. I contend that we have a right to complain if our man is compelled to spend two nights on the sleeper in order to do three minutes work that could have been avoided if some one had made a conscientious effort to look for the trouble before putting in the call for help. We feel that we have a right also to expect that our machines will be repaired and adjusted by competent mechanics or by operators who have been properly instructed in the requirements of field repairs. We feel, also, that the railroads should provide a reasonable degree of mechanical supervision of the power tools and equipment used in maintenance of way and structures. By this I mean that it is in the interest of both the railways and the manufacturers that the railways provide some sort of an organization that is held responsible for the power equipment—to see that the operators are properly instructed, to guard against overloading and other abuse, and to direct the field maintenance of the appliances as well as their general repair.

In this connection, it may be of interest to remark that we admonish our field men to "keep their hands clean," or, in other words, to refrain if possible from doing the repair work or making the adjustments themselves. We take this position for two reasons, (1) because some railway officers will impose on our men in an effort to get some maintenance work done without expense to the railroads and (2) because we believe that our service men will get better results if they function primarily as instructors. It is much better to *tell* a man what to do, than to *show* him how to do it. If he actually has to do the job himself he is much more certain to get the idea and remember it than if he merely watches someone else do it.

We feel that we have a right to complain if our service man makes a long trip only to find that someone failed to identify or describe the tool properly and that it isn't our device at all. Obviously this does not happen often, and in the case of some appliances would be entirely inexcusable. However, it is not an extraordinary experience with manufacturers of track accessories.

Substitutions

Of course, we sometimes encounter conditions where we have no choice but to disclaim any further responsibility for what had been our product. I refer to the substitution of nonstandard parts in making repairs. If, for example, an internal combustion engine has been equipped with new pistons, purchased from some concern other than our own, we contend that it is no longer strictly our machine and that we cannot be expected to make it run properly. Such substitute parts may not fit to the close tolerances required for effective operation, but even if the controlling dimensions are correct, the deviations from standard weight may be such as to throw the moving parts out of dynamic balance.

One of the most troublesome problems arises from the abuse of equipment. Systematic mechanical supervision, which I have referred to pre-

viously, is the most potent means of avoiding injury to machines through improper use. But the railroads' equipment supervisors cannot be everywhere at once and in spite of all that is said, some operators will neglect to oil their machines. Still more pertinent is the trouble that arises out of the failure to use the lubricant specified in the instruction sheets. The correct lubrication of rapidly moving parts is a complex problem and the answer is to be had only through long experience or carefully conducted tests; for this reason it is sheer recklessness to substitute lubricants other than those specified without painstaking investigation. Difficulties arising from the failure to use the right oils or greases give rise to field service that the railroad has no right to expect.

Another source of trouble for the manufacturer is overloading. Our company does not make motor cars, but I mention them here because every one who has anything to do with maintenance work has seen cars grossly abused by overloading. Usually the man responsible has some justification—an emergency that he has to meet with the means at his disposal. No doubt a lot of equipment was subjected to abuse of this kind during the recent flood in the Ohio river and with ample reason. However, I feel that the manufacturers of motor cars are entirely justified in expecting that regularly assigned motor cars will be of adequate capacity for the gangs and equipment that they will have to handle and regular service.

Service Tests

Closely allied with this subject of service is the matter of service tests. Taken as a whole, the railways deserve a great deal of credit for the extent to which they have co-operated with supply companies in carrying on the pioneer work, without which the extensive mechanization of maintenance of way work would not have been possible. No appliance can be conceived in its final form in the mind of the inventor, nor can it be built in the shop to such a degree of perfection as to assure that it will do exactly what is expected of it.

Realizing this, it is the general practice to arrange for the experimental use of a new machine on one or more railroads, and since it is recognized that the appliance is not a finished machine, ready for sale, it is placed at the disposal of the railroad without charge, in return for which the latter is expected to carry out the required test conscientiously. As a result of this arrangement, the manufacturer obtains valuable information and, not infrequently, some pertinent suggestions for the improvement of the device.

However, this status of an appliance no longer obtains after the experimental work has been completed and the design has been changed to overcome the defects disclosed by the tests. When, therefore, the product has been shown by subsequent retrial to function to the satisfaction of the manufacturer and he is ready to stake his reputation on it by offering it for sale, it can no longer be classed as an experimental appliance. Nevertheless, in spite of this and the fact that the device is in extensive use on some roads, salesmen are not infrequently importuned by officers of other roads to have an appliance installed on their lines free of charge as a "test installation."

I mention this as an example of another type of "service" that the railways have no right to expect of the manufacturers. On the whole, railway maintenance officers are entirely fair in their attitude toward the service tendered them by the supply companies, and I am sure that I voice the sentiment of the great majority of the supply men when I say that I am willing to meet the few exhorbitant demands that are made on our company by a few individuals for the privilege of rendering a type of service that is essential in the movement toward a wider use of power appliances in maintenance of way work.

As a Railroad Man Sees It

WHAT field service has a railroad the right to expect from the manufacturer? We have been getting this service for so many years in some form that we have come to accept it as something to which we are entitled as a matter of course. True, some companies provide more of it than others, but some measure of it is offered with almost all equipment bought except that supplied by jobbers. I suppose also that there is a wide difference in the amount of service that different railway officers demand of the manufacturers. Consequently, it is not so easy to distinguish between what is a fair measure of service and what is exhorbitant.

One thing that must be borne in mind from the start is that there is no such thing as free service. It costs money to pay the salaries and traveling expenses of the field men and since no bill for their services is rendered as such, the railroads must absorb the expense in the prices they pay for the appliances they buy. It follows, therefore, that if the manufacturers provide more service than is needed or are compelled to supply unwarranted service because of unreasonable demands made by the railroads, the cost of this excess service must be reflected ultimately in the bill for the equipment.

Field service in some form has been provided by manufacturers ever since railway buying has been in sufficient volume to warrant the organization of what we know as railway supply companies. In the case of new mechanical appliances it could not very well be otherwise. No machine can be 100 per cent reliable; men must also be taught how to use it. Consequently experts must be furnished to check and correct mechanical difficulties and to teach men how to operate and care for the machine. Under the dictates of custom, the manufacturer provides this service without any additional charge. Why is this so?

The offering for sale of any new machine or an old one, for that matter, always gives rise to questions concerning its reliability, the adequacy of its construction to resist the stresses imposed in the course of regular service, the need for frequent adjustments, the degree of skill required of the operator, and a multitude of other matters of practical concern to the potential user. The responses to such questions may range all the way from claims of absolute perfection to a frank admission that a certain amount of field supervision by representatives of the manufacturers is necessary. However, regardless of the nature of the claims made, the manufacturer is bound to make good. In other words, the railroad has a right to expect the manufacturer to provide whatever field service is necessary to make good his claims that the device can perform the work for which it is intended under the practical conditions encountered in day-to-day service.

This statement calls for some elaboration because the situation presented

in the case of a new appliance is entirely different from that prevailing with respect to a machine that has been widely used for a long time. In the case of a new machine, it is up to the supply company to show that men can readily be trained to operate and care for it, that it can readily be kept in the state of adjustment and repair necessary for effective operation, and that it meets in other respects the claims made for it.

Until this has been demonstrated to the satisfaction of the purchaser, the field service man of the manufacturer may have a rather busy time of it, but if the machine is all that is claimed for it, the supply company ought not provide and the railroad should not expect any more field service than is necessary to insure occasional check inspections of the appliances and the methods employed in operating them. We welcome these occasional visits and any helpful suggestions that are offered by the field man that will increase production, insure more reliable performance and guard against abuse of the machine.

This phase of field service is of unquestioned benefit in reducing the number of interruptions to the work by reason of breakdowns. But mechanical difficulties will be experienced from time to time, with the result that we may be confronted with a serious tie-up. This is especially trying in the case of a rail gang, for example, where the failure of one machine will disrupt the work of the entire organization.

There is another point that can well be brought up in this connection. It is my observation that service men seem to feel that their job is to find out what fault of our men led to the failure of appliance. That is the correct attitude up to a certain point, but when we find that one detail of a machine is giving us trouble almost constantly, I think it is time for the supply company's representative to admit that perhaps the design of that detail is defective. Most manufacturers don't waste much time in running down and correcting troubles of this kind, but it is surprising how long it takes some of them to institute needed changes of design. In one or two aggravated cases we have undertaken the job ourselves, making improved parts for the machines in our own shops.

Supply companies oppose strenuously any efforts to get them to furnish equipment that incorporates any feature that is not a part of their standard models, but in some instances that I can recall there has been good reason for demanding it. And another thing—if a part proves defective and the design is changed, I think that the railroads have a right to expect the manufacturer to supply replacement parts of the improved design. It will avoid a lot of the so-called unreasonable service that they complain of.

Emergencies

If the railroad has properly trained its machine operators and provides adequate mechanical supervision, such breakdowns should be infrequent, and when they do occur our own maintenance men should be able to find the trouble and correct it in most cases. However, in cases where they cannot find out what is wrong, or the trouble is of a nature that they cannot correct, we have a right to expect prompt assistance from the supply company. Furthermore, we feel that the manufacturer ought to exercise reasonable initiative in getting an expert on the ground.

We had an experience with a crane some time ago that illustrates this point. This crane was being used within a few miles of a town where the headquarters of the supply company, as well as its factory, are located, and when we had trouble we thought that this was one case where we could get help quickly and at little inconvenience or expense to the manufacturer. However, we were notified that all of the field men were out on other assignments so far away that they were inaccessible. Apparently it did not occur to anyone that there should be some one in the factory who could pinch-hit for the regular service men in this instance.

Spare Parts

In many cases, of course, the emergent need is not for the services of an expert but for some part to replace a broken one. The first requirement in this connection is that the manufacturer provide us with parts lists from which all parts can be clearly identified and accurately specified. We also have a right to expect that reasonable effort will be made to get repair parts to us promptly.

However, this matter of replacement parts cannot be disposed of with that one comment, because it is, after all, one of the most potent sources of controversy between the user and the supply company. In the first place, the railroad should be willing to carry a supply of spare parts, but it is entitled to conscientious counsel by the representative of the manufacturer. He should be in a position to know what parts are most likely to need replacement, but in relying on his knowledge we have a right to expect that we will not be inveigled into buying a stock of parts that runs far in excess of any actual need.

Another sore point is the cost of spare or replacement parts. I have heard all the arguments justifying the exorbitant prices charged us, and no doubt the prices must include much more than the cost of the cast iron or steel, the machine work, and the handling charge, but I think most railway men still find the bills for spare parts hard to accept. Perhaps this reaction, even if it is emotional rather than mental, may explain why some of us offer but half-hearted objections when the stores department supplies us with "boot-legged" parts for some of our machinery.

Good Service Men

On the whole, I believe that we are getting all the field service we are entitled to, looking at it from the standpoint of volume or the number of men employed in it. I believe also, that it is generally satisfactory with respect to quality. The service men usually are fully qualified experts in the appliances with which they have to do. We have no right to expect them also to be trackmen. However, we do expect, while they are on our road, that they be engaged exclusively in work relating to the operation and upkeep of the equipment supplied by the companies that employ them.

Naturally, a man who "knows his stuff" and has a pleasing personality will build up no small measure of good will for his employer's appliances, but he should not engage in direct sales effort. We were once subject to considerable inconvenience by a staff of service men who, judging from the requests we received from our own men on the line, must have spent most of their time creating a well defined demand for a lot of accessory equipment.

It is not my job to tell supply companies how to select their service men.

(Continued on page 209)

Keeping Work Equipment in Working Order

THREE factors must be given careful consideration if the successful operation of work equipment is to be assured. These include the condition of the equipment when it is placed in service at the beginning of the working season; the manner in which the various units are kept in repair while in service; and the manner in which they are operated.

On most roads the use of modern types of work equipment, powered with internal combustion engines, was started on a small scale in an experimental way, with little thought of the problem of upkeep. The previous experience of the maintenance forces had been with large steam-driven units that seldom required attention between shoppings. In the event that repairs in the field became necessary, it had been customary to rely on the mechanical department to make them. Almost immediately, however, the advantages of the newer type of power equipment to perform the tasks of maintenance became apparent, and the number of machines in use increased rapidly.

Within a short time the problems of maintenance and operation of these machines became of paramount importance. Neither the maintenance of way department, which was using them, nor the mechanical department, which had been maintaining the older and larger steam-driven equipment, was organized or equipped to maintain these newer types. In large part this was also true of their operation.

As has always occurred when new problems have faced the railways, different roads have worked out the solution along somewhat different lines, although they were seeking the same objective—effective and economical operation of the work equipment that was being placed at the disposal of the maintenance forces. The following articles describe the manner in which two roads, the Illinois Central and the Pennsylvania, both of which are large users of work equipment, solved these problems of maintenance and operation along somewhat different lines, but to their own satisfaction.

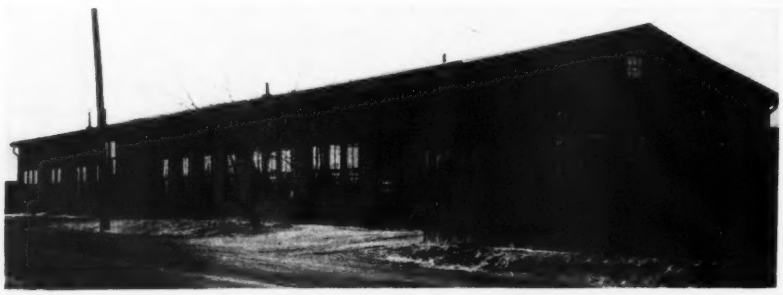
Division Forces Maintain Power Tools on I.C.

By R. E. BUSS,

Superintendent of Work Equipment, Illinois Central

THE Illinois Central has long been a large user of work equipment. It has today in active service a total of 4,570 units of such equipment of 78 separate types, not including locomotive cranes, camp cars or work cars other than ballast and air-dump cars. There are also a considerable number of units of various kinds which are either obsolete or worn out and which are to be replaced as opportunity is afforded. In all, this equipment represents an investment exceeding $1,750,000.

All of these 4,570 units are assigned to and used by maintenance of way forces and 4,265 of these units are kept in repair currently by an organization of equipment repairmen in this department, working in the field and in shops specially provided for this purpose. The remaining 305 units are maintained by the mechanical department. From $100,000 to $110,000 is spent annually for these current repairs.



The Equipment Repair Shop at Champaign, Ill.

Except pile drivers and bridge derricks, the earliest of the modern types of work equipment purchased by the Illinois Central were gasoline-driven inspection cars, the first of which were purchased about 1901. The next machines were locomotive cranes and ditchers, bought in 1904 and 1905. The question of maintaining these pile drivers, bridge derricks, locomotive cranes and ditchers gave no concern as they were all steam-driven, and the mechanical department was able to make any repairs that became necessary. The motor cars presented another problem, however, for neither the engineering nor the mechanical department had made any exploration into the field of internal combustion engines. For this reason, when a mo-

tor car needed repairs, the water-service repairman was called on to make them, because he was the only person available who knew anything about engines of this type, since gasoline engines were being used in numerous water stations and these repairmen were maintaining them.

Use of Equipment Expanded

From this time, as other types of equipment became available, the number of units increased gradually until about 1916, when the shortage of labor occasioned by the industrial expansion incident to the World War gave an impetus to the use of power machines, and motor cars and tie tampers began to be purchased in quantity. Since that time the number of units continued to increase up to and including 1930. During the last two years there has again been an upward trend, despite the fact that the large percentage of the units purchased have been for replacement.

Originally, the larger units were turned over to the mechanical department when they needed repair. These heavier machines rarely needed field repairs and the maintenance of way department had neither the tool equipment nor men who were qualified to make the more important repairs which had to be made in the shop. However, as the smaller units, such as motor cars, air compressors, etc., increased in number, it became evident that their effective operation would depend in large measure on efficient field repairs.

Field Repairs Difficult

Obviously, the mechanical department was not organized to make field repairs to this equipment as a routine operation. Even when a request came in to send a mechanic to some point on the division to inspect or repair a machine, it was seldom possible for him to drop the work he was doing and start immediately. Furthermore, experience soon disclosed that these men were rarely sufficiently familiar with internal combustion engines to repair them satisfactorily, while not infrequently they were completely in the dark as to the source of the trouble which they were sent to overcome.

While the failure of a motor car to function might be aggravating to the section gang to which it was assigned, it was not a matter of large importance in the total maintenance operation. It was thus generally immaterial whether the repairs were made today or next week, provided the supervisor had a hand car which he could send for the temporary use of the gang. As the number of cars in service in-

Believing that there is an advantage in requiring the department that uses power machines to maintain as well as operate them, the Illinois Central has developed an equipment maintenance organization in the maintenance of way department along divisional lines, each division having an equipment repair shop able to handle all but large steam and M. C. B. units. Experience has shown that this system is workable and economical and that the shops are capable of turning out high-grade work at relatively low cost.

Top—All Shops Are Equipped with Power and Machine Tools—One of Several Drill Presses at Champaign. Middle—Last Operation in the Repair of an Air Compressor—Using the Paint Spray. Bottom—One Corner of the Shop Store Room

creased, however, these failures began to be a serious matter, particularly as they occurred with disturbing frequency in the engines with which these earlier cars were equipped.

Serious as the motor-car failures might eventually have become, they never assumed the importance that attached to those of machines which were used with large gangs. When a tie tamping outfit failed it became another matter, for an entire ballast gang might be thrown into confusion and its progress slowed down to the point where the cost of the work increased beyond reason. It thus soon became apparent that some organized action was necessary to insure the continued and effective operation of the increasing amount of work equipment which was being provided.

It was equally apparent that little help could be expected from the mechanical department since it was also suffering from a shortage of men while from the very nature of its work it was not organized to handle field repairs regularly. For these reasons, and because the bridge and building department always contains a number of capable mechanics, it came to be the practice to call on the supervisor of bridges and buildings to make the repairs as they became necessary.

Genesis of Shops

Eventually this practice was expanded to include more important repairs, which necessitated sending the machines to a shop and finally to include other classes of equipment and major repairs at the end of the season. Thus what had originally been a local effort to keep motor cars and, later, tie tampers, in operation, gradually grew into a regular equipment maintenance operation.

For a long time each division was allowed to handle the problem as it saw fit, that is, independently of what other divisions might be doing. However, as the amount and variety of the equipment in service continued to increase, it became necessary to coordinate the efforts of the individual shops and about 14 years ago this work was placed under the direction of the supervisor of work equipment. Subject to this supervision, the maintenance of work equipment still remains a division matter. Each of the 10 divisions has one shop, while in the consolidation of divisions a few years ago two others were retained, making 12 in all. Each shop is in charge of a mechanic who may have one or more mechanics and helpers under him.

It is also worthy of note that the mechanics in charge of most of these shops still report to the division supervisors of bridges and buildings as they did in the beginning, although one reports to the supervisor of water service and another to the signal supervisor on their respective divisions, thus indicating the point from which the practice of repairing equipment started on these two divisions.

What Is Done

All steam and M.C.B. equipment and units which come under the safety rules of the Interstate Commerce Commission, are maintained by the mechanical department. These comprise 305 units of 21 types, which include pile drivers, bridge derricks, rail loaders, snow plows, spreaders, lidgerwoods, dump cars and similar equipment, and floating equipment.

Finishing Up the Work on a Spike Puller

The division maintenance of way shops are equipped and the men are trained to make repairs to all other types of equipment and to most hand tools, with certain exceptions which will be mentioned later. This requires that these shops be equipped with machine tools and that a certain amount of blacksmith work be done in each shop. A few tools are sent to the system reclamation plant at Burnside (Chicago) which is operated by the stores department, but all others, including track jacks, track wrenches, tamping and clay picks, mauls and sledges, adzes, lining and claw bars, etc., are repaired in the division shops.

All mobile units, such as motor cars, tamping equipment, air compressors used by the bridge department, rail cranes, adzers, tractors, crawler cranes, draglines, etc., are given field repairs to the fullest possible extent and are sent to the shop for heavy repairs only, usually at the end of the season. In general, the mechanics make the field repairs, while the helpers remain in the shops, unless the mechanic requires assistance which cannot be obtained at the machine. It should be noted, however, that no machine is dismantled in the field, for if repairs requiring dismantling are necessary, the machine must be sent to the shop.

Operators Trained

When a new machine is placed in service on any division, an effort is made to familiarize the mechanics, their helpers and the operator with its construction, care and maintenance. It is the practice to have a factory representative on hand when the machine is placed in service to train the man who is to operate it, this being done with the machine in regular service. So far as practicable, both the mechanics and the helpers from the division shops are required to be present, receive the same training as the operator and demonstrate their ability to operate the unit. The mechanics are then expected to train such additional operators as may be necessary.

While the operator is not held responsible for or expected to make any important repairs to the unit in his charge, he is required to be so familiar with the mechanism and its functioning that he will know how to keep it in adjustment, care for it and use it properly. Thus, while he is not required to qualify as a mechanic, with the knowledge which he acquires as a result of his training he is able to assist the mechanic in making ordinary field repairs.

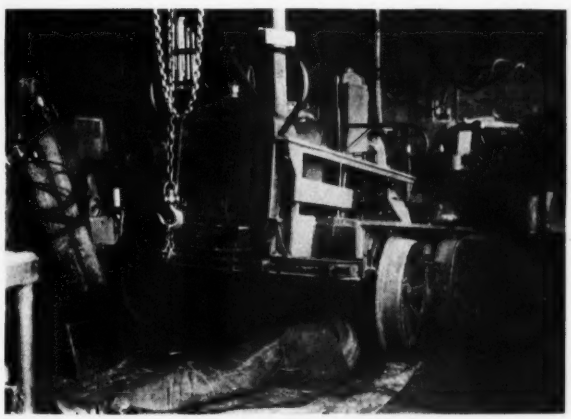
Certain units are assigned permanently to the divisions. Others are rated as system machines and are moved from point to point or from division to division in accordance with a system schedule. Where a unit or number of units of any type are assigned to a division, the mechanic is expected to train enough operators so that there will be several extra operators who will be available to replace regular operators when necessary. Likewise, while operators are

assigned regularly to system machines and accompany them from place to place, the divisions are expected to have one or more men who are qualified to operate these units in emergencies.

Men Kept With Machines

Where large jobs are under way, such as the laying of rail or the renewal of an important bridge, which require a considerable concentration of machines, one or two mechanics are assigned to the keep the machines in repair. They are expected to inspect each machine daily to insure a thorough knowledge of its condition and to guard against possible unexpected failure of any of its parts. They also keep on hand a small supply of those parts which are known to wear rapidly or are subject to breakage.

By giving the various units frequent and adequate attention in the field, it is rarely necessary to send any of them except motor cars to the shop until the close of the season's work. While the latter are sent in for overhauling when their condition warrants, without reference to the season, an effort is made to keep them out of the shop, so far as practicable, during the winter months when other equipment is being overhauled in preparation for the next year's work.



All Shops are Able to Make Both Light and Heavy Repairs to Motor Cars, as Well as to Other Classes of Power Equipment

What Are Repaired

For obvious reasons, rail cranes and draglines are sent to the manufacturers for general repairs. General repairs to all other equipment, except that maintained by the mechanical department, are made in the division shops. All machines which are used with large gangs or which require a large number of men for their operation, are completely overhauled annually, regardless of their apparent need for having this done. Experience has shown that this not only minimizes field repairs, but protects against delays to the work as a result of small failures, which in the long run may be considerably more expensive than overhauling the machines.

Likewise, all tie tampers, air compressors, track oilers, weed burners and all machines used in laying rail, except rail cranes, are dismantled and gone over thoroughly once every year. In general, other units are given general repairs only when inspection indicates the necessity for it. In all cases, when making repairs, safety features are given special attention.

Boring Cylinders

All repairs to the internal combustion engines on these various units are made in the division equipment shops, except the boring of cylinders, there being several reasons for this exception. A cylinder-boring machine represents a considerable investment, which would of necessity be multiplied by 12 if all of the shops were equipped. Also, no individual shop has enough work of this character to warrant the necessary investment in a machine that will lie idle most of the time. Furthermore, because of the many sizes of engines, a surprisingly large additional investment would be required for the necessary stock of oversize pistons and rings.

On the other hand, there are serious objections to concentrating the work of boring cylinders at one or even two shops on the system. Not the least of these is that it would require the shipment of all such work to these centers and, of course, the return of the finished product to the originating division.

Investigation showed that at every point where maintenance of way repair shops are located, there are one or more outside shops which make a specialty of boring cylinders, some doing this work exclusively. Through a process of selection, it has been possible to secure high grade work at these shops at a cost that is considerably less, in most cases, than the cost of carrying the investment in the machines and stock of parts necessary to permit this work to be done in the division shops.

Equipment Reports

One of the important features of the system of maintaining equipment on the Illinois Central is the monthly report made by each division, covering every active and inactive unit of equipment. This report contains, among other items, information regarding the condition of each unit, whether it is inactive and the reason therefor and the number of days it was used in the month covered by the report. Section motor cars are not included in this report.

This report permits a quick check to be made on the location, condition and use of all equipment. On the other hand, it does not contain any information with respect to what it is costing to keep the machines in service. For this purpose a supplemental record is kept, showing the cost of operating and maintaining every active unit of equipment owned.

This record shows at once any increase in either of these costs and if the unit is in good shape the cause is determined and corrected. As it becomes older, the record becomes a guide to the determination of when it should be replaced.

The question of retiring worn out and obsolete machines is given close attention, and when the cost of operation or maintenance, or both, becomes far enough out of line to make it uneconomical to retain a unit in active service it is retired. Obviously, since 1930, the practice of retiring machines in this way has not been followed as rigorously as is the practice in more normal times.

Despite the difficulties of these years, however, retirements have been made with a fair degree of consistency and as much liberality as could be justified, and where this could not be done immediately the units have been removed from the active list and stored until the retirement could be consummated.

It is because of this close check and the prompt removal from the active list of units for which repairs are beginning to be excessive that the cost of maintaining the active equipment has been kept within the limits that were mentioned earlier, that is, $100,000 to $110,000 annually. Particular attention is directed to the fact that the average cost for repairs during 1936, a year of relatively high maintenance activity, was well below $25 per unit, including all machines in active service, a rather high percent-

age of which are approaching the age of retirement.

Compared with recent years, a considerable amount of new equipment was purchased during 1936, although this had only a slight influence on the unit cost of making repairs during the year, since the number of new units was small as compared with the total number in service. It is probable that a still larger number will be purchased this year and in the years immediately following, to bring the remainder of the equipment up to date. This should have a cumulative effect in bringing the unit cost down still further in the future.

Long experience has shown that the divisional system of maintaining work equipment is workable and economical and that high-grade work can be turned out if the shops are equipped with suitable tools and are given proper supervision. Not the least of the advantages of this system is that the engineering department has full control over all matters relating to repairs and schedules and knows that the work will be done in the manner and at the time desired.

Pennsylvania Centralizes General Repairs

Growing out of a plan under which the overhauling of pile drivers, cranes and other large equipment was handled in mechanical department shops, two shops under the control of that department have been set aside for the repair of all maintenance of way work equipment. This work is carried on in close co-ordination with the maintenance of way department which latter department has developed a divisional system of field inspection and repair of the appliances.

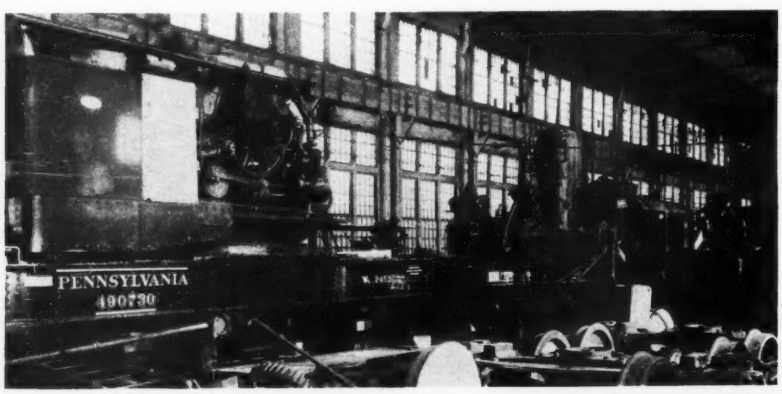
STARTED in a small way on a purely experimental basis, the use of power tools and equipment in maintenance of way work has assumed such proportions that measures designed to insure utilization of the appliances adequate to earn a return on the investment has become a major administrative problem. On the Pennsylvania, which has expended close to $4,000,000 for roadway machines and other work equipment, this problem has been subjected to extended studies that have not only embraced the requirements of adequate supervision and facilities for the repair and overhauling of the machines, but have also taken into account the need for possible changes in the methods of handling work to assure the greatest effectiveness of the appliances. However, this article is confined to an exposition of the organization for the training and supervision of the work equipment operators and an account of the means and methods employed in keeping the appliances in condition for effective use.

Maintenance of way and structures on the system is under the general direction of the chief engineer and the assistant chief engineer, maintenance, while more direct supervision is exercised by the chief engineers maintenance of way of the Eastern, Central, and Western regions and the New York Zone, this article dealing more especially with the Western region, rather than the system as a whole, although the plan as described applies to the entire system of the Pennsylvania in its general elements.*

The plan adopted has been developed to meet the requirements of a railway that is operated under the divisional form of organization. However, adequate provision is made for regional and system control and for the requisite laiason between the maintenance of way and maintenance of equipment departments to insure an effective co-ordination of the field upkeep of the machines during the working season by the former and their general overhauling in shops supervised and operated by the latter. Some idea of the scope of these operations is afforded by the list of work equipment on to the Western region.

Work Equipment Assigned to the Western Region

Pile drivers	3
Cranes	24
Ditchers	4
Spreaders and snow plows	19
Air dump cars	17
Tractors, crawler	2
Buckets, clamshell and dragline	28
Magnets	12
Auto trucks	2
Air compressors	3
Tie Tamper power units	46
Grinders	27
Tie adzers	8
Power ballasters	1
Power drills	35
Power saws, wood	1
Spike pullers	4
Power jacks	2
Weed mowers	5
Weed burners	2
Extinguisher cars for weed burner	4
Mole ballast cleaners	7
Bolt tighteners	11
Milling machines	2
Concrete breaker	1
Concrete mixers	13
Trench pumps	10
Paint sprayers	11
Welding units	2
Discers	2
Rail saws	2

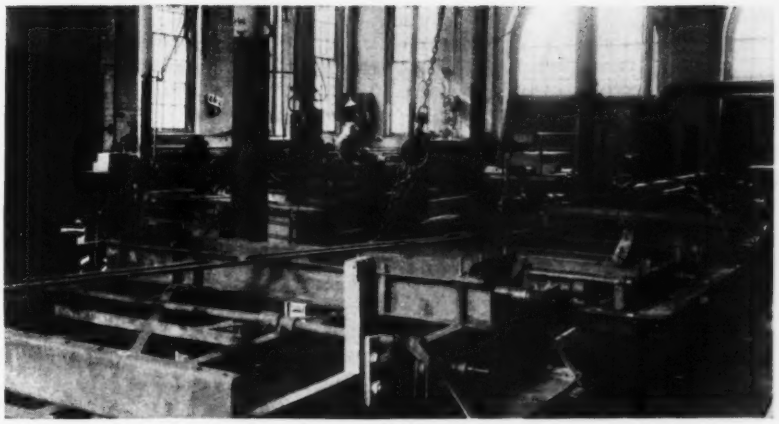


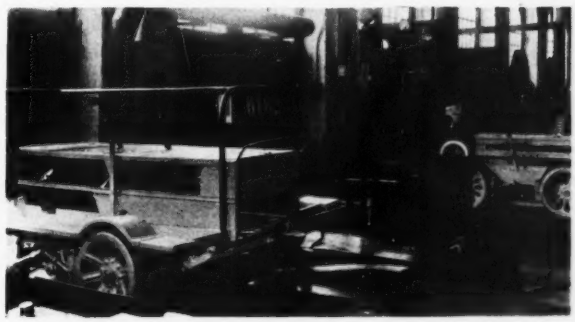
The Shop Is Equipped for Work on the Large Machines

*An earlier article on the Pennsylvania's methods and organization, dealing particularly with the Eastern region appeared in *Railway Engineering and Maintenance* for March, 1931, page 244.

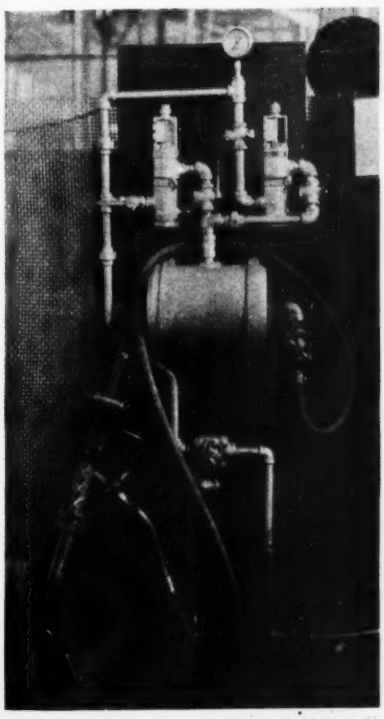
Maintenance of way work equipment is overhauled in two shops assigned especially to this class of work, one shop being located at Renovo, Pa., and the other at Fort Wayne, Ind. In general, machinery on the Eastern region and the New York zone is repaired at the Renovo shop and that on Western region at the Fort Wayne, while work on equipment of the Central region is divided between the two shops.

Most work equipment used by the maintenance of way forces of the Pennsylvania is assigned to the divisions and operated by division forces. It is, therefore, the general rule that the divisions are responsible for the efficient operation and effective upkeep of the machines during the working season. For this reason the selection, training and supervision of the work equipment engineers and machine operators are essentially division functions. Rail laying is done by gangs that cover more than one division, and this is true also of such operations as weed burning, discing, mowing, etc. Consequently, the machines employed in such work are operated on a regional basis and, so far as possible, each machine is operated by the same man throughout the season, regardless of division limits. However, these operators and work equipment engineers are in all cases responsible to the officers of the divisions on which they are at work.





Above—The Motor Car Shop. At Right—The Motor Car Test Rack. Below—Air Consumption Test for Pneumatic Tools



Supervision of the operation of the machines is exercised by the division officers responsible for the work being done. They are assisted, so far as it relates to the working condition of the equipment and the requirements for proper care of the appliances while on the job, by the division machinery maintainers, one or more of whom is assigned to each division. General supervision over the equipment used in the entire region is exercised by the chief engineer maintenance of the region, with the assistance of a member of his staff who devotes a large part of his time to this work. This staff assistant also maintains a close contact with the shop where the machinery is repaired and co-operates with the shop foreman in dealing with the various matters that arise in connection with the annual overhauling of the work equipment.

The operators of the machines are chosen from the men in the department who bid for the positions as they are advertised. However, before they are selected the men must qualify for the positions by demonstrating to the satisfaction of an examining officer that they can operate the particular machine to which they are to be assigned. Because much of the machinery now being used is operated by internal combustion engines, some knowledge of the gasoline engine is a requisite for success as a machine operator. However, as most young men now have some experience with the overhauling of automobiles, it has not been difficult for the railway to recruit men for work on its power tools who have at least some knowledge in this field.

Three Classes

The men who operate the machines are divided into three grades or classes, determined in part by the degree of knowledge or skill required and in part by the relative amount of manual effort demanded in the operation of the machines. These classes are designated as Work Equipment engineers—Class 1, Work Equipment engineers—Class 2, and Machine Operators.

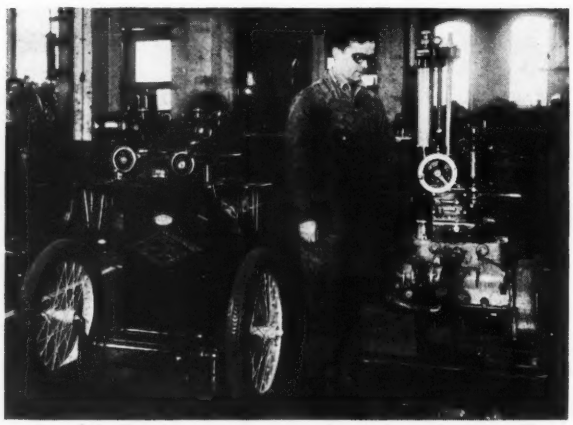
A work equipment engineer, either Class 1 or Class 2, is required to make running repairs and adjustments on his machine and keep a reasonable supply of tools with him. When occasion demands, the division machinery maintainer assists him. A machine operator is not required to know how to repair and adjust his machine but is expected to know when repairs and adjustments are necessary and arrange for them to be made by the division machinery maintainer.

In general, the Class 1 engineers are assigned to pile drivers, large spreaders, moles and large ballast cleaners, and to power machines when used in excavating or handling bulk material that requires more or less continuous effort. The Class 2 engi-

neers are assigned to cranes equipped with hooks rather than buckets, dippers, etc., and to ballast discers, rail-laying cranes, weed burners, steam operated concrete mixers, etc. The machine operators are assigned to the less complex equipment such as drills, mowers, rail saws, adzers, air compressors, gasoline-operated concrete mixers, electric generators, auto trucks, etc.

Training

Having been selected for the position, the operator is instructed in the use of the particular machine by one of the division machinery maintainers, who stays with him until he thoroughly understands its operation and has acquired some skill in handling it.



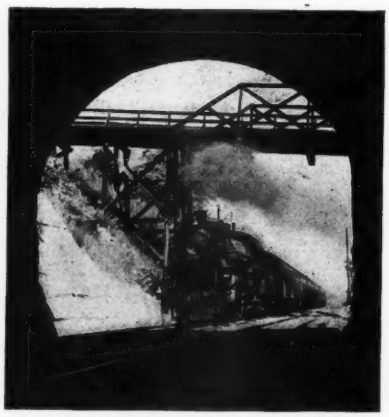
Portable Machine for Boring Cylinders and Other Precision Work on Engines

To supplement this coaching, each operator is provided with a book of instructions that was prepared several years ago by a committee of the railroad's officers. This book contains general instructions that go into considerable detail regarding the use and care of machinery, and also embraces briefer instructions concerning each of the types of power appliances that were in use at the time that the book of instructions was prepared. The book also provides a lubricating chart for each machine, specifying the name of the lubricant, the symbol and the storehouse number. In addition, instruction sheets and stock lists provided by the manufacturer are also furnished each operator.

This initial instruction is followed up during the operator's employment by supervision on the part of the track supervisor, the division engineer, the engineer maintenance of way and the chief engineer maintenance of way, or members of their staffs, who observe the operation of the machine and note its general condition whenever they are present, and check over the daily performance records. The operators also come under the observation of the division repairman in their routine trips over their territories, as well as when they have occasion to make adjustments or field repairs of the machines. As the machine operators are expected to learn enough about machinery so that they can qualify for a position in the next grade—that of work equipment engineer—Class 2, he assists the repairman in any repair work done on his machine, and as he increases his knowledge and skill, he makes minor repairs and adjustments himself.

The division repairman occupies a key position in the plan for effective supervision and field upkeep of the work equipment. One or more of these repairmen is assigned to a division, the number depending on the number and kind of machines in use on the divisions and the transportation facilities available. Obviously, the first requisite for a repairman is that he be a competent mechanic, with sufficient knowledge and adequate experience with the various machines that he is required to look after, so that he is readily able to dismantle, repair, adjust and assemble any one of them.

An important feature of his duties concerns his responsibility for the motor cars on the division or that part of it assigned to him. He is required to make a thorough inspection of every motor car at intervals of 60 days and make a detailed report concerning each one. In addition to the other facts covered in the report, it shows whether the car is being kept clean, a feature that is given special attention, as its condition in this regard is considered an excellent index of the care the car is receiving in other respects—whether it is being lubricated regularly and is being inspected for loose rivets, cracks, etc.



The Pan American of the Louisville & Nashville

Cranes must be given a thorough joint inspection every month by the division machinery maintainer and a representative of the maintenance of equipment department in the presence of the crane operator. An inspection form is made out and signed by the inspectors and operator, one copy being posted in the crane and additional copies being forwarded to the division engineer, the chief engineer maintenance of way and the shop foreman to whom the maintenance of equipment inspector reports.

A crane that has not had an inspection report posted in the cab within the last 30 days is considered out of service and must not be operated until inspected. This inspection applies to all cranes, including those not covered by the various boiler regulations. These inspection reports furnish a means of anticipating and providing for the shop repairs on the cranes.

Tie tamping equipment is not given scheduled periodic inspections, but during the working season it is kept under close observation through the agency of daily performance reports and frequent visits of the track supervisor and the division engineer or other officers of the department. The daily report forms the basis for a tabulation that is prepared in the office of the chief engineer maintenance of way that shows the hours worked, the work accomplished, the number of tools operated and the delays. At the end of the season this tabulation is summarized to show the number of hours the machine has worked and this information, together with the report of an inspection made when the machine was taken out of service, provides the basis for an estimate of the extent of the repairs that will be required before the opening of the next season.

Other Machines

Machines such as spreaders, scarifiers, discers, weed burners and mowers, that may operate on several divisions during a season, are operated

as far as possible by one man during the entire season. The operator is required to keep his machine in working condition but when necessary, may procure assistance from the division machinery maintainer. At the close of the season the machine is sent to the shop and the operator makes an inspection and prepares a report that is forwarded to the chief engineer maintenance of way.

As stated previously, the maintenance of way work equipment shop is operated by and under the jurisdiction of the maintenance of equipment department. However, the expense incurred in the operation of this shop must, of necessity, be incorporated in the budget of the maintenance of way department. Consequently all work done must be authorized through the chief engineer maintenance of way of the region, who notifies the foreman of the shop through established channels concerning the amount of money that is available from month to month, and necessarily designates on what machines it is to be expended.

Work Programmed

A tentative program of the year's work is prepared from a study of the inspection reports and other information, including the anticipated requirements for the season's work of the department. While it may not be possible to adhere to this program in its entirety, it serves as a guide in preparing the monthly estimates for the work to be done in the shop.

The shop foreman is provided with copies of the end-of-season inspection reports of all the machines forwarded to him, together with a record of the hours that each machine was worked since the previous shopping. in any case where there is any question as to whether the machine has had sufficient service to warrant a complete overhauling. These matters are taken up with a representative of the chief engineer maintenance of way, and before any work is done the machine is tested to determine the extent of the repairs required. For example, power plants are tested for their efficiency, while pneumatic tools are checked for air consumption, each tool being marked to show the number of cubic feet of air consumed per minute. If the consumption is excessive, the tools are dismantled, calipered and repaired, or discarded as indicated by the inspection. Electric tools are dismantled and all wiring and insulation tested. In some tools it is desirable to test the resistance of windings, for this resistance test will frequently expose defective joints that otherwise would not be detected. Necessarily, the cost of putting an appliance in first-class condition is gone into carefully before work is authorized, and in the event that the cost exceeds an established percent of the cost of the machine, authority is requested to scrap it.

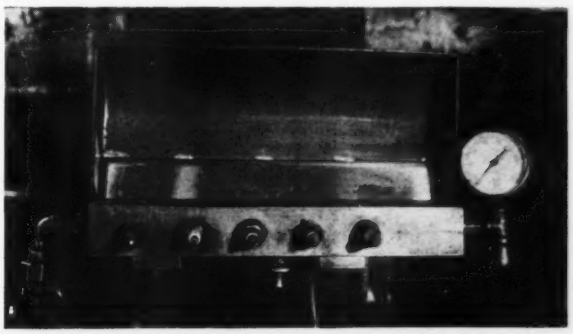
The Shop at Fort Wayne

The shop at Fort Wayne is equipped to handle all work on maintenance of way work equipment, from a magneto for a motor car to a complete locomotive crane. It includes facilities and personnel to handle boiler, forge, machine, sheet metal and cabinet work, together with the necessary tool room, and separate departments to handle air-brake work and the repair of motor cars and internal combustion engines. A portable machine for precision work in the boring of cylinders and grinding valves and valve seats is necessarily an important item in a shop where the overhauling of internal combustion engines is a leading activity.

The shop force also includes competent welders that are constantly employed on both gas and electric arc welding. When the occasion has demanded this force has welded, straightened and heat-treated manganese castings to restore their austenitic structure.

Supplementing the regular shop force, the work equipment engineers are sometimes assigned to the shop while their machines are being repaired. This not only insures a better understanding between the field and the shop, but also enables the field men to test out and tune up their machines before they leave the shop.

The motor car shop, together with the cabinet shop, where all woodwork on the cars is done, is tooled to handle as many as 20 motor cars per week. It includes a test rack where the cars are checked for horse-power output after the overhauling has been completed. This same procedure is carried out on all power units.



Spark Plugs Are Tested Here Under Actual Service Pressure

All machinery is inspected to determine what failures or defects occur with the greatest frequency, and as soon as it is determined that some part is likely to cause more trouble than should be reasonably expected, it is called to the attention of the manufacturer. If he fails to correct the difficulty an effort is made to do so at the shop. A card record is kept at the shop which shows when new parts were applied to each machine. This furnishes a basis for anticipating when replacements may be expected and a comparative service record of such repair parts as pistons and rings.

Activities Co-ordinated

While the field repairs and the shoping of the machines are handled by separate departments, the two activities are so thoroughly co-ordinated that there has been no difficulty in ascertaining responsibility for troubles experienced with the machines. The inspection and performance reports have proved especially valuable in determining the efficiency of the operators, and have demonstrated that competent and conscientious operators are a prime essential in the egective output of power equipment.

On the New York Central in the Niagara Gorge

Laying a Million Tons of Rail in

During 1937 the railways will undertake the largest rail-laying program since 1930. How will this rail be laid? What methods will be employed? What types of organizations will be used? How thoroughly will they be equipped with time and effort-saving equipment? What are the present trends along these lines? All of these questions are discussed in this article.

IN VIEW of the large tonnage of rail that has already been ordered for laying this year and the certainty that even this figure will be increased materially as the season advances and business in general continues to improve, rail renewal promises to be one of the outstanding items of railway maintenance of way work in 1937. During this year, the roads as a whole will receive and lay considerably more than 1,000,000 tons (possibly approaching 1,500,000 tons) of rails, definite orders having already been placed for more than 950,000 tons, with numerous additional orders pending and in prospect. This clearly indicates that the railways are facing the largest rail-laying program since 1930, comparing with 985,000 tons of new rails laid in 1931 and 575,874 tons of new rails laid in 1935, the last year for which complete figures are available.

Facing this large program, it is pertinent to raise the question as to how the work will be carried out, to discuss the developments and trends in rail-laying practices in recent years and to review the experience of certain roads which during recent months have been giving detailed consideration to rail-laying programs, organizations, equipment and methods. Such a discussion is of timely interest, not alone because of the rapidity with which developments have been and are still taking place in rail-laying equipment and methods, but also because of the ever-increasing demand that this work be done with maximum efficiency and economy. At the same time, it is essential that the work be of the highest order to minimize possible damage to the new rail, while with increased traffic and faster schedules in both passenger and freight service interference with traffic must be held to the minimum.

Summing up the situation, it is evident that speed and economy, combined with high-quality work, will keynote the rail-laying programs in 1937 even more prominently than in the years immediately preceding. In the first place, with deferred maintenance all along the line, there is an earnest determination on the part of maintenance officers to catch up as rapidly as possible. In the second place, while unemployment is still a serious problem in many localities, there is no longer pressure to employ a disproportionate amount of hand labor, at sacrifice of efficiency and economy. In fact, with so much deferred work to be done, it is now widely recognized that increased employment is brought about just as effectively by enlarged programs of constructive work carried out by labor with the aid of equipment, as by severely curtailed programs of work carried out largely by hand labor.

Developments in Equipment

Interrupted only for a year or two in the depth of the depression, the trend on most railways during the last decade has been definitely toward the increased use of mechanical equipment to facilitate and speed up maintenance of way operations, and this has nowhere been more noticeable than in rail renewal. The gradual increase in the weight of rail and, during the same period, a necessary decrease in the number of man-hours available for carrying out work, created a definite need for specialized machines for laying rail, possessing speed, efficiency and portability.

Sensing this need, the railway supply companies have continued the development and refinement of equipment, even during the lowest ebb of

Some Machines Do Much Better Work Than Can Be Done by Hand

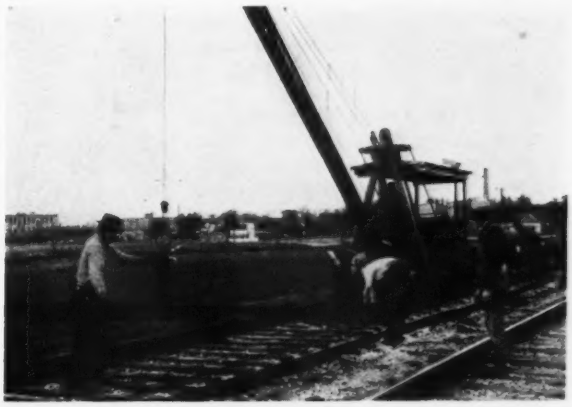
Hand Labor Will Always Be Required for Some Operations

il in 1937

the depression when sales were at a minimum, with the result that at the present time the maintenance forces of the railways have available to them a wider variety of highly developed equipment to assist them in their work than ever before. This is true particularly of rail-laying equipment. The sizeable purchases of such equipment during the last year by several roads, some of which were taking their first major steps in this direction, vindicate the judgment of these manufacturers that only by the most complete and intensive use of mechanical aids can the greatest efficiency and economy be effected.

What are some of these tools and units of equipment that are now available to and are being used by those railways which have given major attention to this subject, and whose records of lowering production costs attest the value of mechanized forces? They are to be found for practically every operation in rail-laying work, from the distributing of new materials to the picking up of the materials released. Taking them in the general order of sequence of operations in rail-renewal work, they comprise power rail unloaders, including wheel and crawler-mounted cranes of various types operated on flat cars; power-operated nut runners or wrenches for uncoupling the old rail, either in the track or as lined out; acetylene cutting outfits and pneumatically-operated rivet busters for removing bolts with "frozen" nuts; power spike pullers of both pneumatic and gasoline engine-operated types; power adzing machines; power tie-scoring machines for use where hand adzing is still employed; special rail-laying cranes or locomotive cranes, operated by steam, gasoline or Diesel engines, for setting in the new rail; pneumatic, electric and gasoline or Diesel-engine-operated rail drills; power wrenches of various types for turning up joint bolt nuts; pneumatic cut spike driving hammers; power rail saws, acetylene cutting equipment and high-speed grinding wheels for making closure cuts in rails; power and hand-operated bonding drills and welding equipment for the application of signal bonds; power-operated wood boring tools and machines for boring ties for both cut and screw spikes; power-operated wrenches for turning down lag screws in tie plates; power nut runners and wrenches for applying special bolted types of rail fastenings where used in lieu of cut spikes; grinding machines for cross-cutting and chamfering rail ends; grinding units for removing mill tolerance in the height of new rails; electric arc and acetylene torch equipment for the field end-hardening of new rails; and cranes and rail loaders of various types, equipped with tongs or magnets for picking up released rail and fastenings. To this list must be added improved types of gasoline engine-driven and Diesel engine-driven air compressors, and the latest types of portable electric generating units for supplying electric power to many of the tools.

In all, this list of equipment includes more than 50 different types and makes of power tools and units of work equipment especially adapted or designed to facilitate and speed up rail-laying operations; to produce a higher quality of work, and to insure the greatest possible life from the rail.



Fewer Men Handling Rail Means Fewer Injuries

Each Step in the Work Must Be Coordinated with Every Other Step

The trend in rail-laying organizations in recent years, especially on the larger roads, has been unmistakably toward regional or system gangs trained in rail-laying operations with continuous programs ahead of them, replacing the local division and subdivision organizations formerly formed by the bunching of section and extra gangs and limited in the radius of their work. These large specialized rail-laying organizations vary in size from as few as 75 men to as many as 200 or more men, depending upon the extent of the operations, the amount of equipment employed, and the speed with which it is desired to complete the program and to minimize interference with the operation of trains.

Shifting of Gangs

On some of the roads these large gangs are maintained practically intact from one division to another, the men being housed in camp cars that are moved from place to place as work progresses. On certain other roads with large programs, the system or regional gangs consist essentially

of a neucleus of possibly 40 to 60 men, trained tool and equipment operators and foremen, which is supplemented as it moves from place to place by local section and extra-gang forces.

On a few roads, rail is still laid by extra-gang or heavy-work forces, filled out to a full rail-laying organization by section forces, but even in these cases an effort is usually made to maintain the neucleus intact as long as possible in order to capitalize upon the experience gained by the men as the work progresses. Of course, section gangs are still bunched for laying rail on many roads, especially where programs are limited or where the sections of track to be relaid are relatively short and widely scattered, but the economy of the larger gangs is gaining increasing recognition.

Regardless of the type of organization employed, even in the cases of the most highly organized system organizations, the rail-laying forces almost invariably work under and report to the roadmaster or supervisor in charge of the territory on which the work is being carried out. In other words, the local roadmaster or supervisor is given full authority to supervise the work, and assumes responsibility for the quality of work done and the progress made.

Advantages of Special Forces

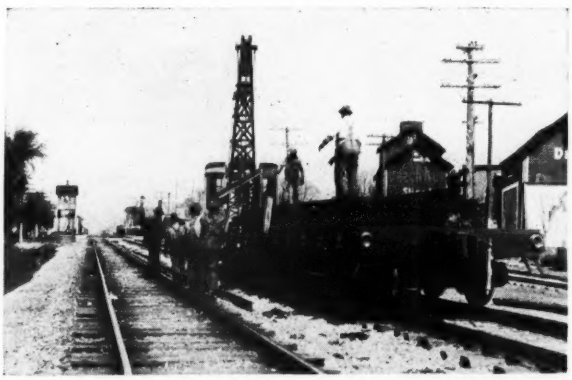
What are the advantages to be gained through specialized rail-laying organizations? In the first place, the men in these organizations, concentrating day after day on rail-laying operations, become more proficient in their work, with increased production over that possible where the men are employed for a short time in many smaller gangs. Such organizations permit also the more economical and effective use of power tools and equipment; enable supervisory officers to watch the work more closely and to apply promptly such measures as will expedite it; and minimize the number of points of traffic interference or delays. In addition, the large specialized organizations makes it possible to spread the work more uniformly throughout the active working season, thereby simplifying the problem of the stores department in supplying the materials required, and it also permits distributing the rail-laying charges over a longer period.

Supplementing these direct advantages, there are a number of other advantages, largely intangible although none the less important. The use of such gangs has demonstrated that it tends to develop a higher degree of cooperation between the maintenance of way department and the transportation department. As a matter of fact, the very size of such a gang and the obvious importance of avoiding delays in carrying out its work often cause other departments to make special efforts to expedite its progress, which they would not feel impelled to do with smaller, hand-tool-equipped gangs. Furthermore, under some circumstances, the very impracticability of taking the regular gangs off their sections for a sufficient length of time to permit their engaging in sizeable rail-laying operations, is an added argument for specialized gangs. This is true particularly in territory where the section forces have been reduced to a minimum and their territories lengthened materially in recent years.

A danger of large specialized rail-laying organizations is the possibility of inadequate supervision, although most roads with such forces have recognized and overcome this danger by placing a sufficient number of skilled foremen and assistant foremen in charge of the various operations, with a carefully selected general foreman or gang roadmaster in complete charge. On some roads so much importance is attached to this position that a roadmaster is detached from his regular duties and assigned full time to the work of supervising such a gang.

Large specialized rail-laying gangs call for the extensive and judicious use of mechanical equipment in order to secure maximum production consistent with quality work; conversely, the most effective use of extensive mechanical equipment in rail-laying operations calls for specialized forces, both as regards the use of the equipment and in the rail-laying work as a whole. In other words, it is impossible to secure maximum production in such arduous operations as those involved in laying rail without the assistance of laborsaving equipment, regardless of the forces employed, and, at the same time, the securing of maximum efficiency from work equipment requires trained forces for its operation and an adequate, carefully organized supporting force to insure that it is kept moving forward in productive work with a minimum of delays.

Where a force is highly mechanized, so much depends upon the efficient working of each unit of equipment that it is considered highly desirable that the rail-laying organization include one or more trained mechanics or work equipment repairmen; that arrangements be set up in advance to secure needed repair parts with a minimum of delay; and that adequate hand tools be kept with the force in the field to permit temporary adjustment of any part of the organization to hand operations in the case of an equipment failure.



Loading and Unloading Rail Have Long Been Handled with Power Machines

What Method of Laying?

The most efficient size of the rail-laying organization to be employed depends upon many factors, which include the extent of the work, the speed necessary to complete the program within specified time limits, traffic conditions, the amount and character of equipment employed, the extent of the operations involved, and the specific method of carrying out the work. One of the most important of these is, of course, the method of carrying out the work.

The most generally accepted practice is to renew one line of rails at a time, although one or two roads have made it a practice at times to relay both lines of rails at the same time, employing organizations of practically double size and duplicate outfits of equipment, one working a short distance ahead of the other. While this method avoids the backward movement otherwise necessary for laying the second line of rails, it involves a larger investment in equipment for mechanized operations and an organi-

zation so large as to tend to become unwieldly unless supervised most carefully. At the same time, any delays to an organization of this size become doubly expensive, a factor of no small importance when it is realized that the labor expense alone for such an organization may well exceed $100 an hour.

Another method of relaying rail which is used to some extent, especially in territories of heavy traffic, is the set-up or string method. In this method, the new rails are set up and fully coupled together directly on the ends of the ties, in lengths ranging from a few hundred feet to one-half mile, depending upon conditions, and are then lined over into place later as the old rail is lined out of position. This method necessarily precludes the use of as large a complement of labor-aiding tools and equipment as the other method of laying, but it reduces the length of time the track needs to be broken and permits rapid track closures where the work is done under heavy important traffic. This method has been generally conceded to cost more than the highly mechanized methods employed with the exclusive use of the track. Yet, one road, questioning the accuracy of this belief in view of its own limited experience, plans to conduct production and cost tests of the set-up method in average main line track during the present year, through which it hopes to establish definitely, as least insofar as its own conditions are concerned, the relative economy of the set-up method in comparison with other methods of doing the work.

Power Tools Have Been Provided for Many Tasks

Accepted Practice

Regardless of the method and organization employed in laying rail, and of most of the special features of track construction which are being employed by some roads, there are numerous details of procedure and practice in laying rail which are so generally accepted as essential to the greatest efficiency in performance and the highest quality of work, that they will only be mentioned here. These include a carefully prepared and scheduled program, prearranged for close co-operation with the stores and operating departments; carefully organized forces and adequate trained supervision of the various operations involved.

Regarding the work itself, it is considered essential that the track be in sufficiently good line and surface to receive the new rail; i.e., that any low joints are tamped up in advance of the rail-laying work; that all materials are carefully distributed in advance of the actual rail-laying operations to avoid delay to these operations; that the renewal of turnouts in the path of the work be taken care of by special forces before or after the out-of-face rail laying, likewise to avoid delays to the rail-laying forces and their equipment; that the preparation of the track through highway crossings to receive the new rail be carried out sufficiently in advance of the rail-laying forces to prevent delays; that all equipment employed be in first-class condition and that provision be made in the rail-laying organization to insure that this condition is maintained throughout the work; that all old spike holes be plugged to their full depth; that machine adzing is preferred to hand adzing; and that the adzed surfaces of all treated ties should be coated thoroughly with creosote or other suitable preservative.

Other generally accepted details of procedure are that proper and uniform expansion allowance should be provided between successive rails; that the ends of the new rails through the contact area of the joint bars should be clean and be coated with oil to insure uniform expansion and contraction adjustment within the joint gaps; that all tie plates should be set square with the rail; that rail-holding spikes be driven vertically, tight to the rail base; that care be taken to avoid nicking or otherwise damaging the rail, especially the base flanges; that care be exercised in applying joint bars to insure that they are driven or drawn in tight at the base; that joint bolts be tightened uniformly; that the application of anti-creeping devices be kept close behind the rail laying; and that each day's work should be closed up complete, insofar as full spiking, bolting, anchoring and bonding are concerned.

Following as closely as possible after the completion of the rail renewals, it is considered essential that irregularities in line and surface be corrected, and loose ties be tamped solidly or, preferably, that the track be given a light raise out-of-face to insure uniform support for the new rail. It is also considered important that all joint bolts be gone over after a period of about a week, and again after a period of three weeks to a month, to take up any slack due to further seating of the joint bars and to insure a uniform degree of bolt tightness throughout.

When new tie plates are applied and lagged to the ties independently of the rail, a subsequent tightening of the lag screws is desirable a month or more after the initial installation to compensate for any initial settlement of the tie plates in the ties. For this, as well as for the original turning down of the lag screws, power equipment is available.

Supplemental Operations

Until recent years, rail renewal work was considered complete when the new rail was fully spiked and anchored in position and the released material had been picked up. This is still recognized as sufficiently complete to permit the full resumption of traffic, but an increasing number of roads now consider several supplemental operations on the rail essential to a complete job in order to insure minimum maintenance of the new rail, while at the same time increasing its service life. These operations include the slotting of the rail ends, usually providing a slight chamfer at the top of the head to minimize end flow of the head metal with subsequent chipping and cracking off; the surface grinding of the rail ends to remove any uneveness in height due to mill tolerance, and to bring the ends to a true common surface; and the heat-treating or hardening of the new rail ends in the field, if they have not been end-hardened at the rail mill.

None of these operations affects or interferes in any way with the actual operations of laying the rail since they

(Continued on page 208)

A.R.E.A. to H
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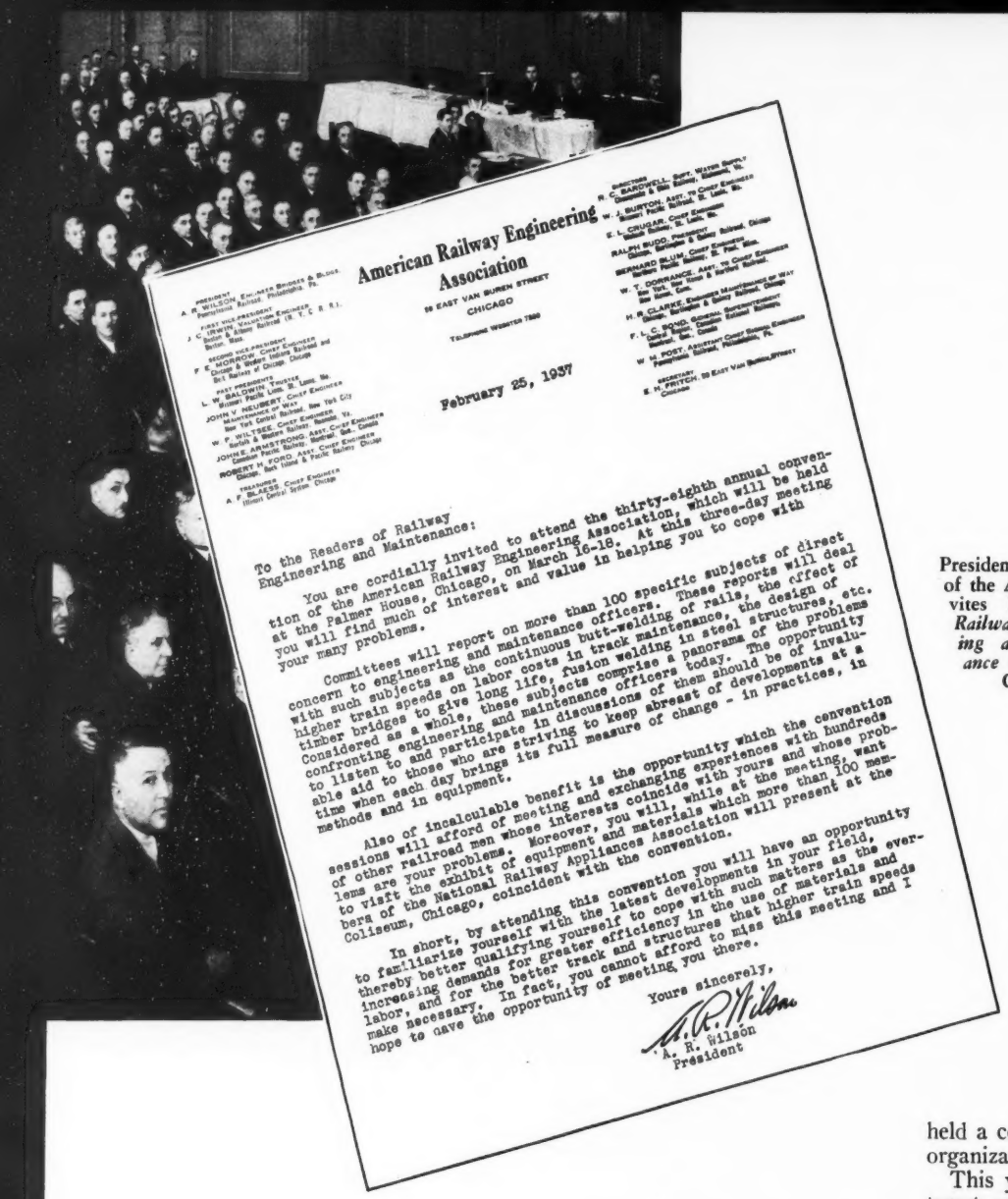


American Railway Engineering Association
59 EAST VAN BUREN STREET
CHICAGO
TELEPHONE WEBSTER 7800

February 25, 1937

To the Readers of Railway Engineering and Maintenance:

You are cordially invited to attend the thirty-eighth annual convention of the American Railway Engineering Association, which will be held at the Palmer House, Chicago, on March 16-18. At this three-day meeting you will find much of interest and value in helping you to cope with your many problems.

Committees will report on more than 100 specific subjects of direct concern to engineering and maintenance officers. These reports will deal with such subjects as the continuous butt-welding of rails, the effect of higher train speeds on labor costs in track maintenance, the effect of timber bridges to give long life, fusion welding in steel structures, etc. Considered as a whole, these subjects comprise a panorama of the problems confronting engineering and maintenance officers today. The opportunity to listen to and participate in discussions of them should be of invaluable aid to those who are striving to keep abreast of developments at a time when each day brings its full measure of change - in practices, in methods and in equipment.

Also of incalculable benefit is the opportunity which the convention sessions will afford of meeting and exchanging experiences with hundreds of other railroad men whose interests coincide with yours and whose problems are your problems. Moreover, you will, while at the meeting, want to visit the exhibit of equipment and materials which more than 100 members of the National Railway Appliances Association will present at the Coliseum, Chicago, coincident with the convention.

In short, by attending this convention you will have an opportunity to familiarize yourself with the latest developments in your field, thereby better qualifying yourself to cope with such matters as the ever-increasing demands for greater efficiency in the use of materials and labor, and for the better track and structures that higher train speeds make necessary. In fact, you cannot afford to miss this meeting and I hope to have the opportunity of meeting you there.

Yours sincerely,

A. R. Wilson
President

President Wilson of the A.R.E.A. Invites Readers of *Railway Engineering and Maintenance* to Attend the Convention.

Meeting to be held at Chicago on March 16-18 will involve the presentation of 30 committee reports dealing with a wide variety of subjects—Other features include individual addresses, joint dinner with the Western Railway Club and an inspection trip to a rail mill.

THE thirty-eigth annual convention of the American Railway Engineering Association will be held at the Palmer House, Chicago, on March 16-18. At this meeting a wide variety of subjects dealing with current problems in the maintenance and construction of railway tracks and structures will come up for consideration. These subjects will be presented in the form of committee reports, supplemented in a few cases by individual addresses.

By reason of the broad scope of its activities the A.R.E.A. holds a unique position in the railway field and, in fact, among similar technical associations. Its work is conducted primarily through 30 standing and special committees composed of more than 900 members of the association. Each of these committees, through subcommittees, is engaged in the study of from one to ten specific subjects.

That the railway managements recognize in the A.R.E.A. an important force working for efficiency and economy in railway operation is attested by the fact that in periods of stress this organization has been allowed to continue its work while the activities of other organizations were either greatly curtailed or suspended altogether. This happened during the period of federal control and again during the recent depression, although in the latter instance the convention was restricted to two days from 1931 to 1934. Thus, this organization has held a convention each year since its organization in 1899.

This year a feature of special interest will be a joint meeting and dinner with the Western Railway Club at the LaSalle hotel on Wednesday evening at which Dr. A. N. Talbot, professor emeritus of the University of Illinois, will present an address on the Relation of Track to Rolling Stock. Dr. Talbot will also appear on the floor of the convention to deliver a lecture on some phase of the work of the Special Committee on Stresses in Track, of which he is chairman.

Other Speakers

A noteworthy feature of the convention session on Wednesday morning will be a paper by Thomas H. MacDonald, chief of the United States Bureau of Public Roads, who has had an important part in formulating and directing the federal program for the separation of railway-highway grade crossings. In line with a practice that has been followed for some years Professor H. F. Moore of the University of Illinois, who is in charge of the

A. to Hold
h Convention

test party of the Joint Rail Investigation of Fissures in Railroad Rails, will review the progress that has been made in this investigation.

As in past years the convention opens on Tuesday morning, but for the benefit of those members and guests who are in Chicago on Monday, March 15, the Carnegie-Illinois Steel Corporation is arranging to conduct an inspection party through its rail mill and normalizing plant at Gary, Ind. For those desiring to attend this inspection trip transportation will be furnished from the Palmer House to Gary and return, and lunch will be served at the plant. Chartered buses will leave the State Street entrance of the Palmer House at 11:30 a.m., and will arrive at the hotel on the return trip at 5:30 p.m.

Successful Meeting Expected

Continuing improvement in railway traffic and earnings should augur well for the success of the A.R.E.A. convention and it is pointed out that not since 1929 have circumstances been so favorable for a successful meeting. The program covers such a wide field that it is certain to offer something of direct interest and immediate value to every one who is engaged in any phase of the operation, construction or maintenance of the railways.

The convention this year will be presided over by A. R. Wilson (engineer of bridges and buildings, Eastern region, Pennsylvania), president of the association, assisted by E. H. Fritch, secretary, as well as vice-presidents J. C. Irwin (valuation engineer, Boston & Albany), and F. E. Morrow (chief engineer, Chicago & Western Indiana). The program of the convention, indicating the order of the committee reports, is presented on this page.

Program
38th Annual Convention
Palmer House, Chicago

Tuesday, March 16

Morning Session—9 A.M.

Convention called to order
President's address—A. R. Wilson
Report of Secretary E. H. Fritch
Report of Treasurer A. F. Blaess
Reports of committees on
- Standardization
- Yards and Terminals
- Shops and Locomotive Terminals
- Uniform General Contract Forms
- Waterproofing of Railway Structures
- Electricity

Afternoon Session—2 P.M.

Reports of committees on
- Water Service
- Waterways and Harbors
- Complete Roadway and Track Structures
- Roadway
- Ballast
- Adjournment at 4:00 p.m. to visit the exhibit of the National Railway Appliances Association at the Coliseum

Wednesday, March 17

Morning Session—9 A.M.

Reports of committees on
- Wood Bridges and Trestles
- Iron and Steel Structures
- Impact
- Economics of Bridges and Trestles
- Highways
- Address by Thos. H. MacDonald, chief of Bureau of Public Roads, U. S. Department of Agriculture

Afternoon Session—2 P.M.

Reports of committees on
- Rail
- Stresses in Railroad Track
- Signals and Interlocking
- Records and Accounts
- Economics of Railway Operation

6 P.M.

Joint meeting and dinner with Western Railway club at LaSalle hotel to hear address on Relation of Track to Rolling Stock by Dr. A. N. Talbot.

Thursday, March 18

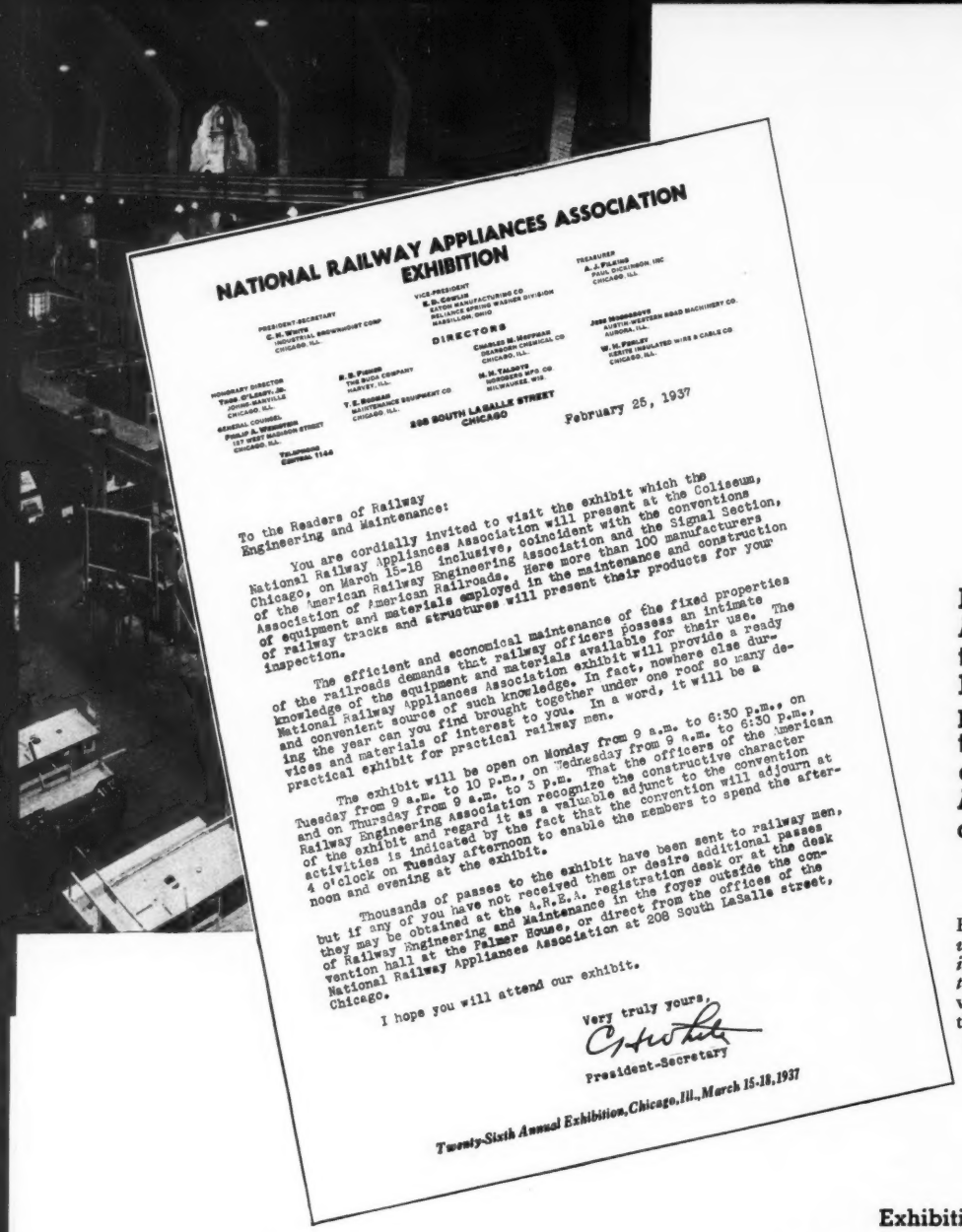
Morning Session—9 A.M.

Reports of committees on
- Maintenance of Way Work Equipment
- Economics of Railway Labor
- Ties
- Economics of Railway Location
- Rules and Organization

Afternoon Session—2 P.M.

Reports of committees on
- Track
- Masonry
- Buildings
- Wood Preservation

Closing Business



NATIONAL RAILWAY APPLIANCES ASSOCIATION
EXHIBITION

PRESIDENT-SECRETARY
C. H. WHITE
INDUSTRIAL BROWNHOIST CORP
CHICAGO, ILL.

VICE-PRESIDENT
E. D. COGLEY
EATON MANUFACTURING CO
RELIANCE SPRING WASHER DIVISION
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CHARLES H. HOFFMAN
DEARBORN CHEMICAL CO
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M. H. TALBOTT
NORDBERG MFG. CO
MILWAUKEE, WIS.

JOHN MONTGOMERY
AUSTIN-WESTERN ROAD MACHINERY CO.
AURORA, ILL.

W. H. PERLEY
OKONITE INSULATED WIRE & CABLE CO
CHICAGO, ILL.

GENERAL COUNSEL
PHILIP A. WEBSTER
127 WEST MADISON STREET
CHICAGO, ILL.

TELEPHONE
CENTRAL 7146

208 SOUTH LA SALLE STREET
CHICAGO

February 26, 1937

To the Readers of Railway
Engineering and Maintenance:

You are cordially invited to visit the exhibit which the National Railway Appliances Association will present at the Coliseum, Chicago, on March 15-18 inclusive, coincident with the conventions of the American Railway Engineering Association and the Signal Section, Association of American Railroads. Here more than 100 manufacturers of equipment and materials employed in the maintenance and construction of railway tracks and structures will present their products for your inspection.

The efficient and economical maintenance of the fixed properties of the railroads demands that railway officers possess an intimate knowledge of the equipment and materials available for their use. The National Railway Appliances Association exhibit will provide a ready and convenient source of such knowledge. In fact, nowhere else during the year can you find such knowledge brought together under one roof so many devices and materials of interest to you. In a word, it will be a practical exhibit for practical railway men.

The exhibit will be open on Monday from 9 a.m. to 6:30 p.m., on Tuesday from 9 a.m. to 10 p.m., on Wednesday from 9 a.m. to 6:30 p.m., and on Thursday from 9 a.m. to 3 p.m. That the officers of the American Railway Engineering Association recognize the constructive character of the exhibit and regard it as a valuable adjunct to the convention activities is indicated by the fact that the convention will adjourn at 4 o'clock on Tuesday afternoon to enable the members to spend the afternoon and evening at the exhibit.

Thousands of passes to the exhibit have been sent to railway men, but if any of you have not received them or desire additional passes they may be obtained at the A.R.E.A. registration desk or at the desk of Railway Engineering and Maintenance in the foyer outside the convention hall at the Palmer House, or direct from the offices of the National Railway Appliances Association at 208 South LaSalle street, Chicago.

I hope you will attend our exhibit.

Very truly yours,

President-Secretary

Twenty-Sixth Annual Exhibition, Chicago, Ill., March 15-18, 1937

Equipment and Exhibit at

National Railway Appliances Association, with more than 100 members participating, will present twenty-sixth exhibit co-incident with the A.R.E.A. convention at Chicago

Readers of *Railway Engineering and Maintenance* Are Invited to Attend the Exhibit at the Coliseum.

WITH more than 100 companies already arranging to participate in the exhibit of the National Railway Appliances Association at the Coliseum, Chicago, during the A.R.E.A. convention, the largest exhibit to be presented by this organization since 1931 is assured. This exhibit of engineering, maintenance of way and signaling materials has been presented annually co-incident with the conventions of the A.R.E.A. and the Signal Section, Association of American Railroads, since 1909, except in 1932, 1933 and 1934. It is recognized as an essential phase of the convention activities and the program is so planned that those present will have ample time in which to inspect the exhibit.

The exhibit this year is being directed by Charles H. White (Industrial Brownhoist Corporation), president-secretary of the National Railway Appliances Association. The companies that will participate in the exhibit, as well as non-exhibiting members of the N.R.A.A., are listed beginning in the next column. To aid in locating their exhibits a floor plan of the Coliseum is also shown, on which the different spaces are numbered to correspond with the list. The hours during which the exhibit will be open and other pertinent information are given in the above letter from Mr. White.

Exhibiting Members

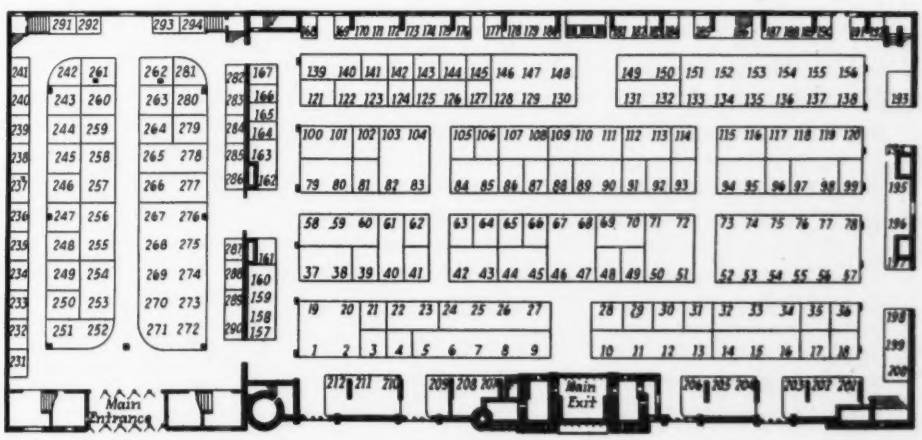
Achuff Railway Supply Co., St. Louis, Mo. 144
Adams & Westlake Co., Chicago 82-83-103-104
Air Reduction Sales Co., New York York 181-182
American Car & Foundry Co., New York 100-101
American Fork & Hoe Co., Cleveland, Ohio 4
American Hoist & Derrick Co., St. Paul, Minn. 48
Ames-Baldwin-Wyoming Co., Parkersburg, W. Va. 106
Armco Culvert Manufacturers Association, Middletown, Ohio 69-70
Armstrong Paint & Varnish Co., Chicago 141
Austin-Western Road Machinery Co., Aurora, Ill. 64
Barco Manufacturing Co., Chicago 105
Barrett Co., New York 87
Barrett-Christie Co., Chicago 255-256
Bethlehem Steel Co., Bethlehem, Pa. 117-118-119-120
Blatchford Corporation, Chicago 18
Buda Co., Harvey, Ill. 46-47-67-68
Caterpillar Tractor Co., Peoria, Ill. 265-278
Chicago Pneumatic Tool Co., New York 10-11-12-13
Chipman Chemical Co., Bound Brook, N.J. 122-123
Cleveland Frog & Crossing Co., Cleveland, Ohio 97-98
Cleveland Tractor Co., Cleveland, Ohio 14-15-16
Conley Frog & Switch Co., Memphis, Tenn. 162-163
Crerar, Adams & Co., Chicago 29
Cullen-Friestedt Co., Chicago 86
Dearborn Chemical Co., Chicago 50-51-71-72
De Sanno & Son, A. P., Philadelphia, Pa. 145
Detroit Graphite Co., Detroit, Mich. 30
Dickinson, Inc., Paul, Chicago 41
Duff-Norton Mfg. Co., Pittsburgh, Pa. 40-61
Eaton Manufacturing Co. (Reliance Div.) Massillon, Ohio 31
Elastic Rail Spike Co., New York 124

and Materials

at Chicago

Associate Members

American Chain Co., Bridgeport, Conn.
Corning Glass Works, Corning, N.Y.
Crown Cork & Seal Co., Baltimore, Md.
DeVilbiss Co., Toledo, Ohio
Frog Switch & Mfg. Co., Carlisle, Pa.
General Railway Signal Co., Rochester, N.Y.
Gould Storage Battery Corp., Chicago
Inland Steel Co., Chicago
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Magnetic Signal Co., Los Angeles, Cal.
Massey Concrete Products Corp., Chicago
National Aluminate Co., Chicago
Northwestern Motor Co., Eau Claire, Wis.
Pittsburgh Plate Glass Co., Newark, N.J.
Positive Lock Washer Co., Newark, N.J.
Pyle-National Co., Chicago
Taylor-Wharton Iron & Steel Co., Chicago
Union Switch & Signal Co., Swissvale, Pa.
Warren Tool Co., Warren, Ohio
Waugh Paint Co., St. Louis, Mo.
Weir, Kilby Corp., Cincinnati, Ohio
Whiting Corp., Harvey, Ill.
Youngstown Sheet & Tube Co., Youngstown, Ohio



Floor Plan of the Exhibit of the National Railway Appliances Association at the Coliseum.

Rail Orders Break Six-Year Record

TO DATE 63 railways have ordered 1,013,953 tons of rails for laying during 1937. Although a number of roads have not placed orders as yet, it is evident that more rail will be laid in replacement in main tracks this year than in any year since 1930. The tonnage of rail laid in replacement in each of the last seven years follows:

1930		1,517,002
1931		984,900
1932		394,536
1933		403,254
1934		631,093
1935		582,794
1936	(Estimated)	950,000

The railways which have ordered rail to date for laying during 1937, together with the tonnages ordered, follow:

Rails Ordered From October 1, 1936, To February 27, 1937

Railroad	Tonnage
A., T. & S.F.	116,916
A. & W. P.	957
A., B. & C.	1,500
A. C. L.	10,000
B. & O.	52,000
Belt Ry. of Chicago	500
Bing. & Gar.	825
B. & M.	6,000
Camb. & Ind.	300
C. of G.	5,000
C. of N. J.	2,000
C. & O.	37,471
C. & E. I.	7,000
C. & N. W.	48,500
C. & W. I.	1,600
C., B. & Q.	30,000
C., I. & L.	4,000
C., M., St. P. & P.	30,000
C., R. I. & P.	35,000
Clinchfield	1,000
D., L. & W.	11,000
D. & R. G. W.	12,640
D., T. & I.	3,350
Erie	21,333
G. T. W.	5,000
G. N.	20,000
I. C.	10,000
K. C. S.	8,000
K. C. T.	200
L. & H. R.	600
L. & N. E.	1,200
L. I.	6,000
L. & N.	27,000
M. C.	3,500
M., St. P. & S. S. M.	6,863
M. P. Lines	35,950
M. & O.	1,200
N., C. & St. L.	6,075
N. Y. C.	82,150
N. Y., C. & St. L.	13,536
N. Y., N. H. & H.	5,000
N. & W.	40,000
N. P.	10,000
Pennsa.	100,000
P. M.	9,200
Reading	5,000
R., F. & P.	1,575
St. L.-S. F.	13,500
St. L. S. W.	1,200
Southern	24,000
S. P.	55,162
T. R. R. of St. L.	500
T. & P.	7,550
U. P.	20,000
Utah	600
Virginian	4,000
Wabash	15,000
W. M.	3,500
W. P.	30,000
W. & L. E.	2,000
	1,013,953

Laying a Million Tons of Rail

(Continued from page 203)

are all performed subsequent to the actual rail laying; however, they are mentioned because they are becoming recognized as definitely allied to rail renewals and are being employed or considered seriously by an increasing number of roads in an attempt to minimize rail-end batter, with its damage to the rail, increased cost of joint maintenance, and generally adverse effect on track riding conditions.

Joint slotting was the first of these supplemental operations to be considered and it has now become standard practice on many roads. Ordinarily, where practiced alone, independent of the other operations, it is usually delayed until three weeks or more after the new rail has been laid, depending upon the amount of traffic. This permits end flow of the head metal under traffic until the cold rolling of the head under the wheel action tends to retard further flow, and then removes this overflowed metal, leaving the ends in such condition as to accommodate any further flow without any tendency for the metal to chip off.

The surface grinding of the new rail ends to insure a true common level of abutting heads and thus avoid a condition conducive of initiating end batter is usually delayed until the new rails and tie plates have fully seated themselves to show the true relation between the rail ends. This is also true of the end-hardening of the rail ends, which, where practiced, usually follows immediately after the surface grinding work. To many roads, the surface grinding appears as yet to be an unwarranted refinement; likewise relatively few roads have yet adopted the practice of heat-treating the rail ends in the field on a large scale. However, as the theory behind both of these refinements comes to be more generally accepted, and with improved equipment of various types already available to carry them out, it is to be expected that both practices will become widely applied as the advantages are demonstrated.

Improvements Effective

What have been the results of the improved methods of laying rail during the last 8 or 10 years? No maintenance officer doubts that they have been highly favorable, including largely increased production, minimized interference with train operation, greatly reduced costs, and a uniformly higher quality of work. The experience of road after road has established all of these results as facts. Many have seen rail-laying labor costs drop from as much as $1,200 to $1,400 a mile to less than $400 a mile, or about 75 per cent, where specialized forces and a full complement of power equipment have been used; these figures including all equipment charges and the cost of picking up the released material. With 1,000,000 to 1,500,000 tons of rail to be laid during 1937, any such saving will amount to a total so large that it cannot be passed over lightly.

Is There a Shortage of Work Equipment?

(Continued from page 187)

generator units and air compressors to operate them, the budgets that have already been authorized include 2,095 units, whereas a total of 1,312 units were purchased in 1936, an increase of 60 per cent.

In considering this comparison between the two years, it should be kept in mind also that the 1936 figures cover 33 roads, while only 27 of these same roads are represented in the 1937 figures. For this reason, when the remaining budgets are completed they should increase the figures for 1937 by 20 to 25 per cent more, thus indicating that the purchases of all of the roads involved in this study will be approximately 75 per cent greater in 1937 than in 1936.

The information received from the officers who participated in this survey indicates that on most roads from 10 to 75 per cent of the total number

of units in service cannot be operated with economy because of obsolescence or wear. It also indicates that obsolescence is beginning to be better appreciated, and that maintenance officers are beginning to scrutinize the operation of their equipment from the viewpoint of its economy relative to more modern machines rather than on the basis of the relative cost of the work when done by hand methods. This changing viewpoint is shown by the statements of numerous officers that they expect to retain these obsolete and worn out units only until they are able to replace them.

That there is a widespread shortage of work equipment is unmistakable. While a few officers are satisfied that they have enough equipment to care for a considerable increase in their forces, the majority recognize clearly that they face a shortage in almost every type, and that much of what they have on hand needs replacement. These latter listed budget recommendations which included from 125 to more than 250 items for their individual roads. This shortage was shown to exist, not only by what was said frankly by most, but also by the fact that several who expressed themselves as satisfied with what they now have are now planning to buy a substantial number of units for both replacement and additions.

Field Service

(Continued from page 191)

They know as well as I do that the know-it-all smart aleck will not last long and that the fellow who spends much of his time knocking a competitor's product is in reality promoting it. I want to call attention, however, to the fact that the service man occupies a peculiar position with respect to the railroad. He is not an employee, but enjoys certain privileges accorded only to employees and may often be mistaken for an employee. Consequently he must be willing to abide by the usual rules of conduct imposed on railway men. When out on the track he must conform to the established principles of safety and when riding trains he must conduct himself in a manner befitting an employee of the railroad.

A field service man can increase his usefulness by functioning as an exchange through which practices on one road are made known to the men on another. But any such service must be conducted with extreme tact, for if he imparts information that is obviously of a confidential nature his hearers will begin to speculate on what he is telling about them. And if he cannot speak well of a railroad he had better not speak of it at all.

This point may seem rather farfetched, but the conduct of service men in this regard has occasionally been a source of embarrassment to their employers. Furthermore, the railroad has the right to expect that the field men will not function as agents in a system of espionage being carried on by one company for the purpose of obtaining facts concerning the products and business of a competitor.

Use Air Tools in Fighting Trestle Fire

PNEUMATIC tools played an important part in fighting a fire of an extraordinary nature that caused serious damage to a Southern Pacific trestle in San Francisco, Cal. For some unknown reason 10,000 gal. of gasoline escaped from a storage tank into a sewer and was eventually emptied into an open channel under the railroad's Seventh Street trestle in that city.

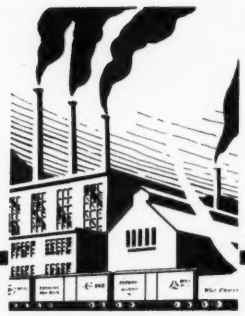
Becoming ignited, the burning gasoline set fire to the trestle and as the tide was running out at the time, the floating fire was carried along the channel as far as Fourth street and set fire to several lumber docks and lumber piles and mills, the total damage being estimated at about $225,000.

Above—A View of the Seventh Street Trestle. Left—The Air Compressor That Was Used at the Fire

The Southern Pacific's trestle, which carries two main tracks and three service lead tracks, is a ballast deck pile trestle, and owing to the limited clearance between the water surface and the decks, and the width of the structure, it was impossible to reach the fire effectively from underneath. Accordingly, an Ingersoll-Rand truck-mounted air compressor was rushed to the site and railway forces were called in to cut through the two feet of compacted ballast with pneumatic tools, and when the floor planks were exposed, air chisels were used to cut holes so that the firemen could insert "circulators" or cellar nozzles for the effective fighting of the fire.

After the fire was extinguished, the trestle was found to be badly damaged and in lieu of renewal, part of it was replaced by a fill of rock and quarry waste.

New Products Of the Manufacturers

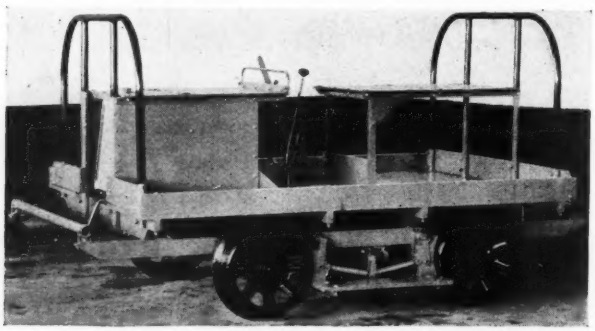


Fairmont A3 Series B Car

FAIRMONT Railway Motors, Inc., Fairmont, Minn., has introduced an improved motor car, known as the A3 Series B type, which differs in a number of respects from the A3 Series A car which was described in *Railway Engineering and Maintenance* for June, 1931. The A3 is the smallest of this company's three sizes of cars that are generally referred to as extra gang cars.

The new A3 Series B car differs from the Series A car in that it is powered with a rubber-mounted 20-hp. Hercules 4-cylinder engine with a Powell muffler, instead of a 15-hp. LeRoi engine; it has a low-hung Blood Bros. propeller shaft with two universal joints replacing flexible disc couplings, this feature permitting a lower deck and body; it is equipped with an improved reverse gear and final drive on a 1 11/16-in. rear axle, which is of the same design as that used in the A6 Series B car; and it is provided with a differential 1 7/16-in. front axle, Timken axle bearings, extra large self-centering iron brake shoes and a demountable body which provides increased deck space and a cockpit for the operator.

Other features include the mounting of the fuel tank on the chassis below the deck and the use of electrically-welded steel construction in the low side step, the rail skid, which is outside of the wheel flanges, and the knee brace. Standard equipment includes an Auto-Lite generator, distributor and storage battery. A starter and electric lights are supplied as extra equipment. The rear lifting or handling weight of the car is 330 lb. and the total weight is 1,428 lb.



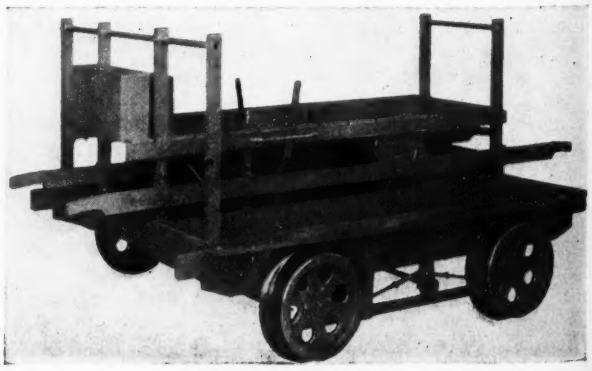
The Fairmont A3 Series B Gang Car

Fairbanks, Morse Light Section Car

FAIRBANKS, Morse & Co., Chicago, has added a light section car, known as Model 52, to its line of Sheffield motor cars, which was designed to fill the need for a car that can be handled safely by one man in track inspection service and yet has sufficient capacity to carry eight men and tools when necessary. Embodying a frame of wood construction with steel reinforcing, the 52 car is powered with an 8-hp. single-cylinder, two-cycle engine with a counter-balanced crankshaft. Power is transmitted through a Sheffield air-cooled clutch and a roller chain drive which is said to be unaffected by heat, moisture, snow or atmospheric conditions. The new car is said to operate 50 to 60 miles on a gallon of gasoline.

Cooling of the engine, which is accomplished without the addition of any moving parts, is effected by a large-capacity blower, built integrally with the enclosed fly-wheel, which delivers air to the front end of the engine and forces it across the cylinder and cylinder head between the cooling fins. The volume of air delivered by the blower is said to be sufficient to cool the engine adequately under any conditions that may be encountered.

The new car incorporates tool trays of sufficient size to accommodate standard lining bars and a full complement of tools.



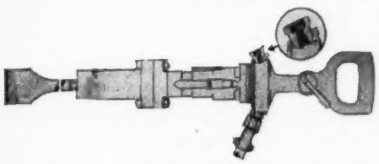
The New Fairbanks, Morse Model 52 Motor Car

Grease Fitting for I-R Tampers

THE Ingersoll-Rand Company, New York, has made available a push-type grease fitting for application to its size MT-2 and MT-3 tie tampers, which is said to make it possible to lubricate the tampers quickly and easily without shutting off the air. Use of this type of grease fitting is claimed to result in a lower consumption of lubricant and in better lubrication of the tamper, thus improving the per-

formance and reducing the wear of the piston, cylinder walls and throttle valve. Located in a special handle plug, the new grease fitting is easily accessible and yet well protected.

When tampers equipped with the new grease fitting are placed in service, each tamper is given three to five "shots" of grease, which procedure is repeated about every two hours thereafter, depending on the operating conditions. Slightly more grease is required in hot weather than during cold weather. One or two "shots" every hour or hour and a half during cold weather is said to provide adequate lubrication and to have less tendency to slow up the tamper immediately after greasing. If a tamper is thoroughly cleaned or if a grease fitting is put on a tamper not previously so equipped, about 18 to 20 additional "shots" of grease are required to fill the grease chamber in the handle.



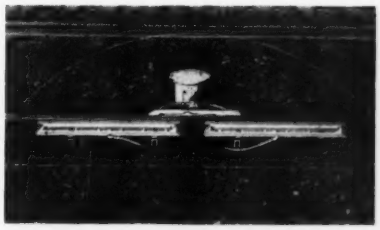
Drawing of an Ingersoll-Rand Tie Tamper Showing the New Grease Fitting

Following extensive tests designed to determine the best lubricant for its tie tampers, the Ingersoll-Rand Company recommends its tie tamper grease No. 90 for this purpose for year-around use. It is claimed that this grease will keep the tampers well lubricated when used according to instructions, will cause little or no gumming and has no tendency to slow up the tamper except for a moment immediately after greasing.

Meco Lubricator Improved

DURING the last year a number of improvements and simplifications have been made in the design and construction of the Type MB Meco rail and flange lubricator, which is manufactured by the Maintenance Equipment Company, Chicago. Among these changes, the ramp lever and the pump lever, each of which was formerly cast integrally with its shaft, are now made in one-piece forgings. This permits reductions in weight without sacrificing strength, and because of the resulting reductions in the inertia of these parts, they respond more readily to the impacts imposed upon them by high-speed trains.

Also, the improved design of the ramp guard now makes this part interchangeable for all rail sections, and permits more ready application of the lubricator where tie spacing is irregular. Likewise, the vertical adjusting set screws at the ends of the waste pans have been eliminated in Mecos equipped with universal interchangeable rail clamps, while vertical adjustments of the lubricant-distributing bar assemblies are now made by inserting spacers of the required thickness under the waste pans to which the distributing bars are attached. This latter change permits the setting of the lubricant-distributing bars at the proper point on the gage face of the rail to suit the train speeds and track conditions in the territory where the lubricator is installed. None of the above improvements affects the interchangeability of parts, so that they can be applied to Type MB Meco lubricators already in service.

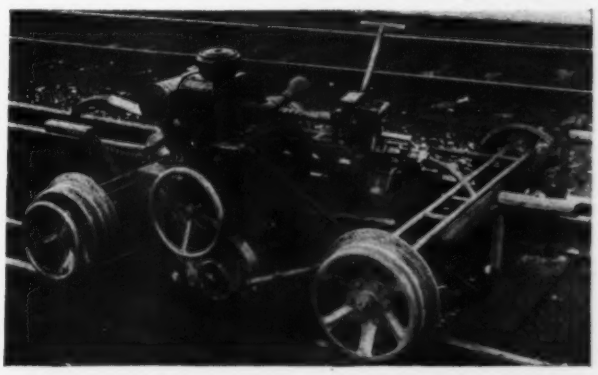


The Improved Lubricator

Light-Duty Rail Grinder

THE MALL Tool Company, Chicago, has developed a light-duty track-mounted rail grinder that is designed for use in smoothing all types of welds on rail ends. Powered with a variable speed, four-cylinder, four-cycle air-cooled gasoline engine which develops 8 hp. at 2,200 r.p.m., the new unit is somewhat smaller than a similar grinder that has been manufactured by this company for some time and which develops 12 to 16 hp.

A four-wheel machine, the new unit, like the older model, is mounted in a rigid steel frame with a four-foot wheel base, and incorporates a flexible-shaft power take-off, a pivot turning device, a precision toggle grinding wheel feed, a spring counter-balance, and skids to facilitate the removal of the machine from the rails.



The New Mall Light-Duty Grinder.

Metal & Thermit Arc Welding Electrodes

THE Metal & Thermit Corporation, New York, has added an electrode, known as Murex Type N, to its line of Murex heavy coated electrodes for arc welding. The new electrode is designed for bridging gaps where the fit-up between plates is poor and, in the smaller sizes, may be used on vertical and overhead work or to make rapid, single-pass welds on light gage materials. In addition, it is said that the new electrodes will produce clean and sound, single or multiple-pass fillets.

The tensile strength of the Type-N electrode is said to range from 74,000 to 84,000 lb. per sq. in., with 26 per cent to 24 per cent ductility. It is also said that the new electrode may be used equally well with either direct current or alternating current and that it may be used either with straight or reversed polarity.

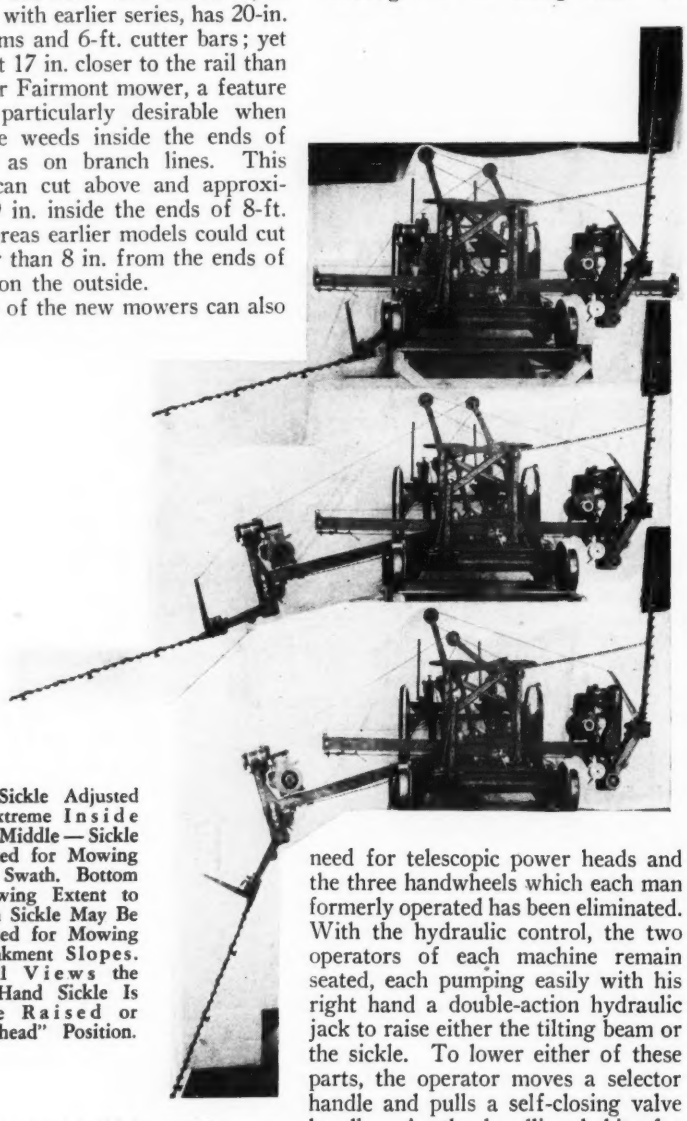
Fairmont Track Mowers

A NEW series of track mowers, known as the D Series M24 mowers, has been introduced by Fairmont Railway Motors, Inc., Fairmont, Minn. These mowers, which consist of the D Series and the D2 Series, are claimed to embody features which make control more rapid and easy and which result in lower upkeep than for any of the earlier series, the outstanding feature being hydraulic control of the tilting beams and sickles.

Compared with the previously larg-

est and most highly adjustable Fairmont mower (the M24 Series C), the new Series D2 reaches 1 in. farther horizontally from the track center line, 2 in. lower, and cuts slightly closer to the rail. The Series D, in common with earlier series, has 20-in. guide arms and 6-ft. cutter bars; yet it can cut 17 in. closer to the rail than any other Fairmont mower, a feature that is particularly desirable when there are weeds inside the ends of the ties as on branch lines. This mower can cut above and approximately 9 in. inside the ends of 8-ft. ties, whereas earlier models could cut no closer than 8 in. from the ends of the ties on the outside.

Either of the new mowers can also be furnished with 32-in. guide arms and 5-ft. cutter bars, which are said to afford still faster control and lower upkeep. They have the same beam extension for the outer swath as the Series C mowers, namely, 58 in., and fold inside of A.A.R. standard clearance as shown in the illustration. In these views the raised cutter bars are fastened with the safety chains for "deadheading" to and from work.



Top—Sickle Adjusted for Extreme Inside Cut. Middle — Sickle Adjusted for Mowing Outer Swath. Bottom —Showing Extent to Which Sickle May Be Adjusted for Mowing Embankment Slopes. In All Views the Right-Hand Sickle Is in the Raised or "Deadhead" Position.

The lower upkeep of the new mowers is said to result from the lessening in each case of the angularity of the pitman with the cutter bar, the steepness of which in some instances formerly caused breakage of the pitman and knife heads. Moreover, an air-cooled 2-hp. engine has been mounted on each beam head, which drives the sickle by means of an endless cord belt, thus eliminating two long belts, six pulleys and other more costly features.

By installing hydraulic control or "rocking" of the tilting beams the need for telescopic power heads and the three handwheels which each man formerly operated has been eliminated. With the hydraulic control, the two operators of each machine remain seated, each pumping easily with his right hand a double-action hydraulic jack to raise either the tilting beam or the sickle. To lower either of these parts, the operator moves a selector handle and pulls a self-closing valve handle. As the handling habits for each side of the machine are identical, each operator can handle the controls for both sides without difficulty. In a factory test the operator, while seated, moved the sickle from the position for mowing an outer swath to the setting for an extreme inside cut in 30 seconds.

The sickles on the new machines commence mowing whenever lowered to the weeds, and stop only when raised to the passing position. Sliding the tilting beam in or out to pass cattle guards, posts, etc., does not stop the sickle from cutting or change its height and tilt in relation to the beam. The sole control of the sickle, the hydraulic hoist cable, is said to be always taut and instantly effective. This cable, as shown in the accompanying views, passes over an adjustable pulley (and two other pulleys) and is attached to the opposite end of the tilting beam. Thus the raising or lowering of the sickle relative to the tilting beam is accomplished by altering the position of the adjustable pulley, which is done by means of an hydraulic plunger.

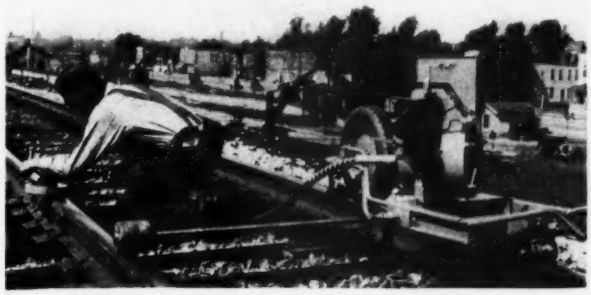
Each of the new mowers is provided with an improved slip coupler of the drawbar link type, thus insuring that it can be hooked, through the standard 1-in. drawbar hole, to any motor car that may be assigned to tow it. Any 6-hp. two-speed motor car is said to be adequate for this purpose, and its driver with the two mower operators comprise the entire crew. The weight of the mower is 2,598 lb. and the lifting weight at the rear end is 334 lb. Three men, it is said, can easily handle the machine to and from the track at planked set-off or road crossings if rules permit.

Mall Improves All-Purpose Grinder

THE MALL Tool Company, Chicago, has improved its all-purpose rail-grinding machine to adapt it for operation on the rails as well as off the track, wheelbarrow fashion. This grinder, which was described in the March, 1935, issue of *Railway Engineering and Maintenance,* embodies a 5-hp. variable speed gas engine mounted by means of a swivel base on a steel tubular base which has a pneumatic wheel at one end and a pair of tubular handles at the other. Power is transmitted to grinding tools by means of a flexible shaft.

This unit has now been supplied with a flanged roller or rail guide at each end to permit it to be mounted on one of the track rails, and a single roller at the end of a steel tubular outrigger which extends to the opposite rail. Both flanged rollers are so designed that they can be inverted, thereby placing them in a position where they do not interfere with the operation of the unit when it is moved about in the manner of a wheelbarrow. The outrigger is attached to the frame of the grinder by means of a specially-designed coupling which permits it to be disconnected readily when not needed. Both the flexible shaft and the extension arm are insulated to prevent interference with track circuits, and the frame of the mounting has been reinforced to enable it to absorb the additional stresses imposed when the unit is mounted on the rails.

A number of additional improvements have been incorporated in this grinder, notable among which is the provision of an arm rest on the angle spindle for the use of the operator.



The Improved Mall All-Purpose Grinder.

Also, all hand spindles that are used in connection with this grinder are full ball-bearing mounted and all working parts are guarded to prevent injury to the operator.

New Switch Heater

FOLLOWING a number of successful test installations during the winter of 1935-36, the Rails Company, New York, has put on the market a new type of hooded unit gas switch heater, or snow melter, which, with the proper number applied to a

Two of the Gas-Trac Heaters in Operating Position at a Switch

switch, is said to afford complete protection against the most severe snowfalls. The new heater, which is called the Gas-Trac heater, is a self-contained unit, consisting essentially of a malleable iron hood, or housing, approximately 8½ in. long, which shields a horizontally-placed, perforated-pipe-type burner; a gas nozzle, suitably vented to insure the most desirable flame at the burner; and a short section of rubber hose for connection to the gas pipe supply line.

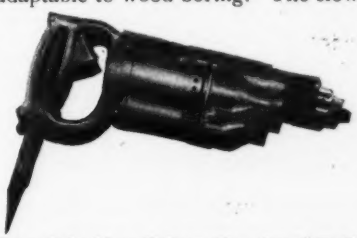
To insure the greatest efficiency of the gas flame, the burner is surrounded by a section of perforated brass tubing, which breaks up the flame, spreading it out throughout the hood. The hood not only protects the flame against being blown out by strong winds or passing trains, but also acts as a reflector, directing the heat toward and into the rail.

Gas-Trac heaters are applied to the outside of the rail and fit snugly against the web and upper side of the base, to which they are held by a simple spring wire clamp. The number of heaters applied to a single turnout switch or slip switch depends upon the length of the switch, but ordinarily, for example, it is recommended that 14 heaters be applied to a switch with 16½-ft. points, 7 heaters on each side.

All of the heaters in a switch installation are intended to be connected into permanently-located pipe manifolds or supply lines, with a single valve so located as to control the gas supply to all of the units. Through their simple spring connection to the rails, the heaters can be applied quickly at the beginning of the winter season, and just as quickly removed at the end of the season.

Slow-Speed Drills

SKILSAW, INC., Chicago, has made two additions to its line of ball bearing electric drills, namely, a ¼-in. and a ½-in. slow-speed, high-torque drills. These drills have been developed particularly for steels of high nickel content although their slow speed is said to make them especially adaptable to wood boring. The slow-



One of the New Skilsaw Slow-Speed Drills

speed feature, moreover, is said to result in longer service life for twist drills and to eliminate the need for frequent sharpening. It is pointed out, however, that drilling speed is not sacrificed because the high torque feature makes it impossible to stall the drills at maximum drilling capacities.

The design of the ½-in. model is said to be new for a drill of its capacity. This model embodies a one-hand grip feature for adapting it to work in close quarters and for use with hole saws in places that are difficult to reach with side-handle drills.

Both models are available in speeds of 350, 450, 600 and 750 r.p.m. They are equipped with ball bearings on the armatures and spindles and have aluminum alloy bodies. The ¼-in. drill is 14 in. long and weighs 6½ lb., while the ½-in. tool is 14½ in. long and weighs 8 lb.

Pipe Clamp for Stopping Leaks

PIPE clamps for stopping leaks in pipe lines conveying steam, water, gas, oil, ammonia or brine are now manufactured by the M. B. Skinner Company, South Bend, Ind. One of

One of the Skinner Pipe Clamps

these clamps, which is shown in the accompanying illustration, consists of a malleable iron cylinder, halved, hinged along one side and fitted with bolts on the other, a gasket of suitable material being inserted over the leak in the pipe. This type of clamp is said to be easy to apply, owing to the long open hinge. The two halves of the clamp may be slid together along the pipe when space is limited, and a small wrench can be used to tighten the nuts on the bolts which are cadmium plated.

Owing to the small area of the average pin hole or corrosion leak, the Skinner pipe clamp is said to stop the leak regardless of pressure. The clamp is delivered complete with a gasket, but if other gasket material is required, it should be cut to the same dimensions as the original gaskets, because if the gasket is too large it diffuses the pressure and it is through concentration of pressure on the leak that this clamp is said to make a positive permanent repair.

This general type of Skinner pipe clamp is available in other designs such as an extended pipe line clamp, a pipe joint clamp which may be readily applied next to a fitting, a

collar leak clamp, a bell joint clamp, a split coupling clamp, a high-pressure weld clamp and various types of band and saddle clamps.

Air Hose Features New-Type Construction

A new type of air hose, designated as Hipress air hose, has been developed by the B. F. Goodrich Company, Akron, Ohio, for all types of air tool applications. This hose embodies a combination construction and is made in long lengths. The inner

Showing the Construction of Hipress Air Hose

carcass consists of four plies of specially woven duck while the outer carcass is comprised of a tight braid of high tensile cords which are said to be applied with a tension ten times that normally used on long length braided hose. Between the inner and outer carcass is a substantial layer of insulation which serves as a secondary tube to prevent the penetration of air through the walls of the hose and to cushion blows from the outside.

The wrapped construction of the inner carcass, because of the fine weave of the fabric, is said to be particularly valuable when the tube is subjected to softening from internal heat. Because of the bias design of the wrapped fabric, any air or fluid which reaches it is said to travel only a short distance before reaching the terminal point of the yarn, thus preventing penetration. It is pointed out that the use of an outer braided carcass imparts greater flexibility to the hose and secure adhesion of the cover.

The tube is made of a special rubber which is said to be capable of resisting both oil and heat. Not only is it claimed that this tube will last longer in air hose service where oil is present but that it will not break into loose particles and clog the tools. The rubber cover of the hose is compounded to withstand abrasion and abuse. Hipress air hose is furnished in three sizes—½ in., ¾ in., and 1 in., and is made in 500-ft. lengths.

What Our Readers Think

B. & O. Bridges at Harpers Ferry

Baltimore, Md.

To the Editor:

Upon opening my copy of the November, 1936, issue of *Railway Engineering and Maintenance*, I was gratified to observe the view of the Baltimore & Ohio's crossing of the Potomac river at Harpers Ferry, W. Va., on page 696. For this reference to one of the beauty spots on our system I wish to thank you.

I take the liberty, however, of calling attention to the fact that the condition indicated by the view in the November issue no longer exists. The bridge shown is the second railroad bridge to be constructed at this crossing and was completed in April, 1894, being used to carry our main line until June, 1931, when the bridge shown on the left in the accompanying photograph was completed.

View Showing the Present Arrangement of Bridges at Harpers Ferry on the Potomac

Bollman Truss Original Span

The Bollman truss bridge, which is downstream (in the background on the photograph) from the other two crossings at Harpers Ferry, represents the original Baltimore & Ohio crossing at this point. The railroad first crossed the river on the line of this structure in 1836, by means of timber arches which were designed by Lewis Wernwag. The rebuilding of the bridge as a series of iron Bollman truss spans was commenced in 1851, but owing to interruptions occasioned by the Civil War and other causes was not entirely completed until 1870. The Bollman truss structure was used for railroad purposes until 1894, when a new line and bridge, passing through the tunnel at the foot of the mountain on greatly reduced curvature, were completed. The Bollman structure was then turned over to the public authorities for use as a highway bridge.

The plate girder bridge shown in the foreground in the photograph was built in 1931, and placed in service in June of that year. By providing the tunnel with a "bell mouth" it was possible to build this crossing on a tangent.

During the floods of March, 1936, several spans in the old Bollman truss bridge on the downstream side, which was then used for highway purposes, were washed out. Since the bridge constructed in 1894, which is the middle structure in the photograph, is used only for the rather moderate traffic passing to and from the Shenandoah Valley branch of the B. & O., we arranged, at the request of public authorities, to provide this bridge with a wooden plank floor, to permit its use for highway purposes. This bridge is reached by means of a highway skirting the toe of the mountain along the river bank. That there was a pressing need for this accommodation is indicated by the enormous volume of automobile traffic which immediately availed itself of this crossing.

P. G. Lang, Jr.
Engineer of Bridges,
Baltimore & Ohio

What's the Answer?

What Causes Soft Spots?

What causes soft spots in the roadbed? How can they be prevented?

Many Interrelated Causes

By W. L. Roller
Division Engineer, Chesapeake & Ohio, Columbus, Ohio

In general, the development of soft spots in the roadbed may be traced to (1) lack of adequate drainage; (2) character of material in the roadbed; (3) excessive wheel loads; (4) type and depth of ballast used; and (5) character of joint maintenance. While these causes are interrelated to some extent, each contributes a definite part to the net result, namely, the development of soft spots into what are commonly known as water pockets. A soft spot is usually disclosed by a dip in the surface of one or both rails and a displacement of the subgrade, as shown by the upheaval of the roadbed material at the shoulder. While a combination of the foregoing causes is usually found, it is believed that they have been listed in the order of their importance.

If it were possible, through perfect drainage, to eliminate water completely from the subgrade, it is believed that soft spots would rarely, if ever, develop. This is confirmed by the fact that a roadbed constructed of sandy, self-draining materials does not develop soft spots. The character of the material is responsible for the development of those soft spots which result from variations in the bearing power of the materials found in the subgrade. The subgrade of the average railway which passes over hills and through valleys contains materials ranging from hard yellow clays to black loam, which vary greatly in their bearing power.

Measured both in number and extent, soft spots occur in about direct ratio to the wheel loads; that is, we experience considerably more trouble with them in our heavy-tonnage lines than in those of light tonnage in the same territory. If the loads imposed on the track could be distributed uniformly to the subgrade, the development of soft spots would be minimized greatly. For this purpose stone ballast of ample depth and heavier rail are employed to insure more uniform distribution of these loads. Poor joint maintenance bears considerable responsibility for the development of soft spots, since the impact of the wheels is increased by the batter of the rail ends. This results in pounding the ballast into the subgrade, thus forming a pocket for the retention of water and eventually causing a softening of the roadbed. Soft spots occur in embankments made by dumping from temporary trestles, unless special care is employed to consolidate the material in the center of the fill.

No absolute means have been found that will completely prevent the formation of soft spots. It has usually been the practice to employ the pound of cure rather than the ounce of prevention in dealing with soft spots. Yet there are several things which can be done to reduce the formation of soft spots under traffic. The first and most important is provision for adequate drainage. Second, is the exclusion or removal of unsuitable and inferior material from the subgrade and the proper crowning of the subgrade to promote the quick escape of water, when the subgrade is being finished. Much can also be done during the construction of fills to insure against the retention of water in pockets.

When soft spots develop and water pockets begin to form, only two alternatives remain, either to continue to apply ballast in an attempt to maintain the surface or to employ some means to drain the bottom of the pocket. Thorough drainage will re-

Send your answers to any of the questions to the What's the Answer editor. He will welcome also any questions you wish to have discussed.

To Be Answered in May

1. What are the relative advantages and disadvantages of spot and group renewals of ties? Under what conditions can each method be applied to best advantage?

2. Should bridge gangs be equipped with portable telephones? What are the advantages and disadvantages?

3. Where rail is being laid in an operated track, what limitations should be placed on the advance removal of spikes? Of bolts? Why?

4. To what extent is it practicable to frame lumber for railway buildings before treatment?

5. Where stone ballast is applied over cementing gravel on a soft roadbed, what should be the minimum depth of the new ballast? Why? Should the track be skeletonized before the stone is applied? Why? How is this done?

6. Is it practicable for local forces to determine the efficiency that is being obtained from fuel or power consumption at a water station? How can this be done?

7. What difficulties are encountered in maintaining track on gumbo embankments? What can be done to improve conditions?

8. What advantages, if any, are there in numbering the bents on long trestles? How should the numbering be applied on creosoted trestles?

sult in stabilization of the track so long as the drainage system functions properly, and should be classed as a cure and not a means of prevention.

All Get Back to Drainage

By W. H. Sparks
General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

While the causes of soft spots in the roadbed are numerous and widely varied, when analyzed they all lead back to a single basic cause—lack of drainage. Soft spots may develop by reason of errors of construction; in fact at one time this was the primary cause for their formation. Lack of care in selecting roadbed materials; improper methods of construcing fills; ignoring needful drainage, on the assumption that this would be taken care of by the maintenance forces after the road was in operation; laying track on a green and unconsolidated fill; and failure to select the proper ballast for the new track are only a few of the construction errors to which soft spots and water pockets can be traced. In recent years there has been a better appreciation of what is likely to happen to the track if these important items are not given consideration, so that many of these errors are being corrected in current construction.

Increasing wheel loads and volume of traffic have caused the sudden appearance of soft spots in roadbed that had previously been stable. In many cases, however, these could have been avoided if a depth of ballast had been provided adequate to insure a uniform distribution of the traffic loads.

Not a few soft spots can be traced to improper maintenance. Among these, poor joint maintenance has started more than a few soft spots by allowing the ballast to be pounded into the roadbed. Raising and widening the shoulders of the roadbed with impervious material placed above the toe of the ballast is another fertile source of soft spots.

How Should Adzes Be Sharpened?

Should adzes be sharpened on a grindstone or on a tool grinder? Why?

Grinder Is Proper Tool

By J. B. Kelly
General Roadmaster, Minneapolis, St. Paul & Sault Ste. Marie, Minneapolis, Minn.

Adzes should be sharpened on tool grinders, because they are quicker and produce just as satisfactory results as a grindstone. For a long time after grinders came into use many trackmen protested the scrapping of grindstones. They had some grounds for this because the early grinder wheels were harsh in texture and the manner in which they were used caused undue heating of the tools and gave generally questionable results.

Now the trackman who depends on a grindstone for sharpening his adzes, seldom has his tools in suitable condition. Grinders may now be fitted with wheels made of coarse, medium, fine or superfine abrasives, and if care is exercised it is possible to grind the cutting edge of an adze to a high degree of exactness. To do so, however, the tool must be held in light contact with the grinding wheel.

To avoid the probability of drawing the temper of the tool, the grinding wheel must be kept true by the regular use of the stone redresser. In extra-gang service where many adzes and other tools must be reground, a gasoline-powered grinder can be used to advantage. In this case, good results are obtained by rotating the grinding of four to six adzes at one time to avoid overheating any of them. Furthermore, to speed up the operation, the tools can be cooled by immersion in water without harming them. Where a keener edge is desired, this can be provided by means of a hand stone following the grinding.

Grindstone Does Not Heat

By W. H. Sparks
General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

While most roads have done away with the old-time grindstone, I am not so sure that this action has been well advised, for I regard it as the best means for sharpening tools that require keen cutting edges. A grindstone produces a smoother and keener cutting edge and, since the speed is slow and water is used, there is no danger of overheating the metal. Furthermore, there is always some hazard from the sparks which accompany grinding on a tool grinder. However, for tools to be used in rough work, which do not require keen edges, the grinder is preferable because of its greater output and easier operation.

Grindstone Too Slow

By E. L. Banion
Roadmaster, Atchison, Topeka & Santa Fe, Independence, Kan.

I do not agree with the argument that is heard so frequently and in so many quarters that a better cutting edge can be obtained on adzes, as well as other tools, by sharpening them on a grindstone rather than on a tool grinder. In the first place, there are many kinds and grades of grinders and of grindstones. The artificial abrasives employed for grinders intended for sharpening edged tools should be finer than those used for heavier and rougher work, such as dressing the heads of chisels.

Carpenters make only limited use of adzes and usually cut clean timber, so that the edge can be kept sharp for a long time by means of a hand stone. On the other hand, the adzes used by the section forces are abused, in that they must be used on rough work, for instance, for adzing ties or other timber containing gravel, stone particles or other forms of grit. To keep such tools sharp requires constant attention, for which reason a grinder, to be of value, must be kept with the motor car where it will be available when needed.

It is impracticable to do this with a grindstone, which is too large and unwieldy to be taken out on the work regularly. In addition, it works so slowly that there is always a tendency to speed up the sharpening operation by beveling the cutting edge sharply rather than grinding it at the proper angle. My experience indicates that from every point of view it is better that adzes and other edged tools be ground by means of tool grinders in preference to grindstones.

Prefers a Grindstone

By J. H. Guest
Roadmaster, Missouri-Kansas-Texas, Woodward, Okla.

It is much better to sharpen adzes and other thin edged cutting tools on a grindstone rather than a tool grinder. The grindstone will produce a keener edge than the artificial stones of which practically all tool grinders are made. The primary disadvantage of the tool grinder is, however, the greater difficulty of producing a keen cutting edge on the tool without getting the thin edge hot enough to

damage the metal and thereby destroy the edge-holding qualities of the tool. The use of the grindstone eliminates any danger of burning the metal.

Depends on Adze

By L. A. Rape
Extra Foreman, Baltimore & Ohio, Wampum, Pa.

A carpenter's adze is frequently used on work requiring smoothness and precision and because the timber is clean the edge does not become nicked or very dull. It is scarcely debatable that a keener, smoother edge can be obtained on a grindstone than on a tool grinder. For these reasons, in sharpening carpenter's adzes, or other tools requiring fine edges, a grindstone is preferable to a tool grinder.

Adzes used by the section forces receive hard usage and are dulled and nicked by gravel, stone and stub spikes. They do not need so smooth or fine an edge and, since the tool grinder will do a much quicker job of grinding and will produce an edge satisfactory for the work to be done, it is preferable to the grindstone for track adzes.

Output Is Essential

By P. O. Ferris
Assistant Engineer Maintenance of Way, Delaware & Hudson, Albany, N. Y.

I would not care to say that either a grindstone or a tool grinder should not be used, for both will sharpen adzes. On our road, however, grinders are being used for this purpose. Several years ago we equipped all of our section and bridge and building gangs with tool grinders and attachments and sent a man over the road to instruct the men as to their use. The adze-grinding attachment was an important part of this equipment.

Although more care is exercised in grinding adzes used by bridge and building men, because of the higher grade of work they are called upon to do with them, as compared with track work, in neither case, and particularly for track work, is it necessary to have a keen and highly accurate cutting edge. Output is essential on any large project, whether it is a job of bridge maintenance or of laying rail. We have found that the tool grinder, because of its ready portability and high speed cutting characteristics, meets the demand for production much better than the grindstone, while a skilled operative can turn out a better grade of work.

When occasion demands, such as in a rail-laying operation, where adzes become dulled quickly by frozen cinders, ballast on the ties, etc., the grinder will remove a large amount of stock from the adze more rapidly than is possible with a grindstone, and without damage to the tool. With ordinary care the grinder does not draw the temper from tools. There is generally at least one man in the gang who is particularly qualified to grind tools. Such a person knows that an adze must be kept in motion while it is being ground and must not be held against the grinding wheel too long at a time.

It is important, however, that the grinding wheel be true and that the proper type and grade of wheel be used. This, together with a suitable adze-grinding attachment, will provide a better cutting edge with less unnecessary loss of material from overgrinding, than can be obtained on a grindstone, where forcing or overcrowding of the tool against the stone is often necessary to get results.

What Is a Paint Drier?

What is a paint drier? How does it affect paint? Should it be used with a bridge paint? If not, why? If so, are there any precautions to be observed?

What Its Name Implies

By Master Painter

A paint drier is exactly what its name implies; it is a material added to the paint before application to hasten the process of drying or hardening after application. There are several types of driers, based respectively on the use of lead, cobalt and manganese. All of them accomplish the same result in the same way, that is by accelerating the oxidation of the linseed-oil vehicle, although different driers may work faster or slower than others. In addition, boiled linseed oil is in itself a relatively rapid-drying oil which dries with a definite gloss, somewhat like varnish, so that it does not need the addition of a drier.

None of the driers made by reputable manufacturers will affect the color of paints. On the other hand they may have a slight effect on white paint. Lead driers are white, but since they are made in oil they tend to become somewhat yellow with age. When combined with oxygen cobalt is blue, which tends to counteract the natural yellowing of the oil. Manganese driers give a slightly pink tint to white paint. It should be understood, however, that, with the quantity of drier normally used, these effects are very slight. If the paint is used outside it is quite certain that these tints will bleach in the sun.

If properly used, I know of no reason why a drier should be barred from bridge paint. The same precautions should be observed as when driers are used with other paints. In other words, the drier should be added to the paint in the proper proportion for the kind of paint and the purpose for which it is to be used. Too much drier will make the paint hard and brittle, while too little will not accomplish the purpose for which the drier was intended. Again certain driers will cause the surface of the paint to harden quickly, and then, as the remainder of the film hardens it wrinkles and later cracks quite badly. Another thing that should not be overlooked is the fact that liquid driers contain a high percentage of turpentine, which should be taken into account when using a thinner.

To Harden Film

By General Paint Foreman

A drier is a material which is added to paint to hasten the process of drying or hardening of the film without producing any harmful effect on the durability or protective value of the paint. Linseed oil, the vehicle most commonly used in paint, does not dry through evaporation of any of its constituents, but through oxidation. If allowed to do so naturally, linseed oil absorbs oxygen from the air and dries slowly. On the other hand, it has a strong affinity for oxygen, and the drier takes advantage of this characteristic to accelerate the process of oxidation by itself taking oxygen from the air and feeding it more rapidly to the linseed oil.

There are several types of driers, known as lead, cobalt and manganese. Space does not permit details of manufacture which, while simple in theory, require careful control and the use of raw materials having a high degree of purity. Manganese and cobalt are very quick in their action and, if used too freely or without some form of retarder, are likely to ruin the paint.

That is, they dry the surface so quickly that as the underlying paint hardens, the surface wrinkles. Furthermore, because of their activity they carry the process of oxidation beyond the point of natural drying, causing the paint to become brittle, shrink and crack and peel from the surface.

Lead acts more slowly, in fact too slowly for many purposes, but produces a very durable film which is tough instead of brittle. Advantage is taken of this fact to mix a small amount of cobalt or manganese drier with a lead drier. This results in the quicker action desired; yet the small amount of the more active agents are not able to carry the process of oxidation, which is actually a form of slow combustion, to the point where the paint is affected adversely or its life is shortened.

There is just as much reason for using a drier in bridge paint as for using it elsewhere. If it is not used the paint will dry too slowly and may be damaged before it hardens. It is particularly necessary that paint on steel surfaces be elastic, for it must respond to the expansion and contraction of the metal as the temperature changes; otherwise it will be destroyed quickly. For this reason, it is particularly important that care be exercised to avoid the use of too much drier or one that is too active.

Are Hewed or Sawed Ties Better?

Is a hewed tie or a sawed tie better? Does the kind of wood or the treatment make any difference?

No Inherent Superiority

By C. D. Turley
Chief Tie Inspector, Illinois Central, Chicago

Properly selected and well manufactured hewed ties have no inherent superiority over properly selected and well manufactured sawed ties, or vice versa, provided the timber in each is similar as to kind, character and quality. Years ago, when most ties were used without being treated, the conditions under which ties were customarily produced gave certain advantages to hewed ties.

These were that (1) they were usually cut from younger and more virile trees; (2) the pith was more likely to be centered in the tie; (3) they were split and adzed (trimmed) along the grain, thus insuring maximum strength; (4) they were generally oversize and rough, giving excellent holding power in the ballast; and (5) they served well as joint ties or support ties for anti-creepers. The first three of the foregoing advantages still apply to hewed ties.

However, now that a large percentage of the ties now being used receive preservative treatment, sawed ties have certain advantages over hewed ties. These are (1) sawed ties are more uniform in size and nearer the specified dimensions; (2) inspection can be made more easily and more rapidly; (3) they are safer to handle, that is, there are less splinters; (4) they can be stacked to give a more uniform circulation of air during seasoning; (5) they require no adzing and thus full strength is retained; (6) it costs less to treat them, since they are not oversize; and (7) because of their uniformity in size, it costs less to handle and apply them.

Sawed Ties Better

By Jesus Alarcon
Trackman, Atchison, Topeka & Santa Fe, Santa Monica, Calif.

If the ties are to be used without preservative treatment, hewed ties are superior to ties sawed from the same wood. The reasons for this are that hewed ties are likely to be somewhat stronger than sawed ones because they are hewed with the grain, while the saw cuts do not generally follow the grain, for which reason sawed ties usually begin to decay somewhat earlier and rot faster than hewed ones.

If the ties are to be treated I prefer sawed ties because they are more uniform in size and shape and are less likely to be oversize. They can be handled and inserted in the track more easily, and give a better support to the rail because the bearing on the ballast is more uniform.

Hewed Tie Preferable

By L. H. Harper
Superintendent Creosote Plant, Central of Georgia, Macon, Ga.

While, in general, I prefer hewed ties, it would not be safe to make the broad statement that all hewed ties are superior to all sawed ones. My discussion will be with reference to ties that are to be treated, particularly those of southern pine, with which I am most familiar.

The majority of hewed ties are of the so-called rifle type; that is, they are cut from logs of comparatively small diameter, with the center as an axis, so that the heart is usually surrounded on all sides by a cushion of sapwood which, when treated, offers a uniform protection to the heartwood. When ties are sawed, the sawing does not necessarily follow the axis of the tree, and the heart may be on one face at one end and on the opposite face at the other end. Then, too, logs of larger sizes are used for sawing, resulting in more split and quartered ties. In all of these cases much of the heartwood is on the surface, with little or no preservative protection.

During the seasoning period hewed ties have a distinct advantage. The sharp blade of the cutting tool leaves the surface of the hewed tie smooth, so that it sheds water much more quickly than the sawed tie, with its surface roughened by the circular-saw blade. This advantage is particularly noticeable in the appearance of the ties in storage, after a long spell of wet weather.

Formerly, in some cases, there was objection to hewed ties because of uneven manufacture, making it necessary to adze spaces to provide even bearing for the tie plates. This has now been overcome largely through machine adzing before treatment. Taking all factors into consideration, I think that, when properly made, a hewed tie is preferable.

Hewed Tie Better

By Henry Becker
Section Foreman, St. Louis-San Francisco, Rush Tower, Mo.

It has been my experience that hewed ties are superior in several respects to sawed ties. In the first place they are generally made from smaller trees so that the pith is in the center of the tie and the heartwood is surrounded by enough sapwood to take much deeper treatment than is usually given to the heartwood. Hewed ties are cut with the grain, so that they are likely to be stronger than sawed ties, which are sometimes cut with little reference to the direction of the grain. Sawed ties, being cut from larger trees, often contain no sapwood, although the pith may be exposed along one face or one edge. For this reason, we sometimes find them more susceptible to season checking and splitting track. Hewed ties, having smoother

after they have been put into the surfaces, shed water much more readily than sawed ties, a real advantage in an area of heavy rainfall.

Thinks Sawed Ties Best

By W. H. KING
Section Foreman, Missouri Pacific Lines, Francitas, Tex.

Before preservative treatment became common practice hewed ties were preferred, because they were believed to last longer than ties sawed from the same wood. This was probably because hewed ties, being smoother and being cut with the grain, shed water more readily, for which reason decay generally started in sawed ties earlier than in hewed ties.

Sawed ties have the opposite faces parallel, are straight and more uniform in size, for which reasons they provide a more uniform bearing on the ballast and a more uniform support for the rail. Furthermore, they are easier to handle and pile better. So far as I have been able to observe, if they are properly treated they will have a service life equal to hewed ties.

Cracking Noises in Radiators

What causes noises in steam coils and radiators? How can they be prevented?

It Is Water Hammer

By GENERAL INSPECTOR OF BUILDINGS

Loud cracking noises which occur in radiators and steam coils are caused by water hammer. Where the trouble occurs in the pipe lines themselves, it is almost invariably the result of failure to grade the pipes so that they will drain quickly and adequately. If the pipe supports are too far apart the line will sag and as the steam condenses water will fill the pockets thus formed. Then when the steam pressure is sufficient to force this water out of the pocket it moves forward at relatively high velocity until it strikes some obstruction, as an elbow.

The same thing happens where a globe valve is used on a low-pressure, single-pipe system, in which the water of condensation must flow over the valve seat. Here the steam will hold the return flow back, causing it to collect in the radiator until a portion of this condensate goes over into the main, resulting in severe water hammer.

To correct the trouble, adequate vents should be used on the radiators or coils, and radiator valves should always be used on the radiators. Pitch ample to insure complete and reasonably quick drainage in the direction of the flow of the steam should be given to all steam mains.

Improper Design

By ENGINEER WATER SERVICE

Improper design of the piping system, improper venting of the coils or radiators and the use of an improper valve, comprise the principal causes of the cracking sounds so often heard in heating systems. Sometimes there are minor noises which result from sudden expansion of the pipes when steam is turned into them after they have been allowed to cool for a time, say overnight. These noises are not loud or offensive, however, and stop as soon as the pipes become heated.

Loud cracking noises that are highly objectionable are caused by water that has become trapped in the lines or radiators and is unable to drain freely. This water is forced from one point to another by the steam pressure, making a sharp, metallic sound at each point where the rushing action is retarded. Again the trouble may be caused by the installation of globe valves in the line, where gate valves or regular radiator valves should have been used. Not infrequently a globe valve will hold back enough water to create a decided disturbance.

Obviously, the remedy in the case of improper valves is to substitute those of correct design. Another precaution is not to open the steam valves too quickly on long runs of cold pipes or large radiators; otherwise, condensation forms more rapidly than it can be drained away, thus causing the hammering noises, even in systems that are designed properly. It is equally obvious that the correction of imperfect drainage lies in the regrading of all offending pipe lines.

Finding the Length of Crossovers

How does one determine the distance between frog points when installing a crossover between straight tracks? On a curve? When the frogs are not of the same number?

Rule Is Simple

By ARMSTRONG CHINN
Chief Engineer, Alton, Chicago

In this discussion it is assumed that the tracks in question are parallel, for if they are not the difficulties of the problem increase and the solution will require the use of more than simple arithmetic. The distance between frog points, referred to in the question, is measured from the frog point in one track along a rail in that track to a point perpendicularly opposite the frog point in the other track, and not the angular distance from frog point to frog point, measured along a string stretched between the points of the two frogs as is sometimes mistakenly thought.

There are several methods for determining this distance. The mathematically exact method, generally used by engineers, requires the use of trigonometry and a good knowledge of mathematics. The methods described here are for the practical trackman and require only a knowledge of simple arithmetic or ability to use a string.

The rule for the solution by arithmetic is as follows:

Let N = the frog number
C = the distance between track centers
G = the gage of the track
D = the distance between frogs, which is to be determined

From the distance between track centers, C, subtract twice the gage, G, and multiply the remainder by the frog number, N. From the figure thus obtained subtract the quotient obtained by dividing the distance between track centers, C, by four times the frog number, N. The figure that is left after this subtraction will be the distance, D, between the theoretical points of the frogs. The actual frog points are usually ½ in. wide, so that the actual point for both of the frogs in the crossover will be behind the theoretical points a distance in inches equal to one-half the frog number. Since there are two frogs in the crossover, the distance between the

actual frog points will be D, as already calculated, less a number of inches equal to the frog number. This is really a very simple calculation which, written out into a formula, becomes:

$$D = (C - 2G)\ N - \frac{C}{4N} - N \text{ inches.}$$

As an example, suppose we want to install a Number 10 crossover between tracks having 14-ft. centers. Inserting the values of C, G and N in the formula, we have

$$D = (14 - 2 \times 4 \text{ ft. } 8\tfrac{1}{2} \text{ in.}) \times 10 - \frac{14}{4 \times 10} - 10 \text{ in.}$$
$$= (14 - 9 \text{ ft. } 5 \text{ in.}) \times 10 - 4\text{-}1/5 \text{ in.} - 10 \text{ in.}$$
$$= 45 \text{ ft. } 10 \text{ in.} - 1 \text{ ft. } 2\text{-}1/5 \text{ in.}$$
$$= 44 \text{ ft. } 7\text{-}4/5 \text{ in., which is the distance between actual frog points.}$$

This formula holds goods for both straight and curved track, so long as the tracks are parallel. It also holds good where the frogs are not of the same number, but in this case one must use the average of the two frog numbers. That is, if No. 10 and No. 7 frogs are to be used, the value of N will be 8½. The use of frogs of different number will put a curve in the crossover, between tracks, but if the frogs have been properly located this curve will be smooth and as flat as the two frogs and the track centers will permit. If the frogs are the same number the crossover will be straight between tracks, provided the tracks themselves are straight.

Determining the distance between frog points with a string is easy to do but difficult to explain. Briefly, the procedure for frogs of the same number is as follows:

1. Locate the *theoretical* point of one of the frogs of the crossover.
2. Measure out one-half gage from the gage side of the rail at this point and drive a stake between tracks. Set a nail in the top of this stake exactly one-half gage from the gage side of the rail.
3. Measure along the rail from the frog point toward the switch point a distance equal to the gage times the frog number, that is, equal to NG. Here, drive a stake in the center of the track and place a nail in the top exactly in the center of the track.
4. Tie a string to this last nail and stretch it tightly over the nail in the first stake, and continue on until the string crosses the center line of the other track. At the point where the string and the center of the track intersect drive a stake and place a nail in the top, exactly in the center of the track and under the string.
5. Measure back from this third stake, away from the second switch point, a distance equal to the gage times the frog number, that is, NG. The point so located will be the point of the second frog, and a fourth stake can be driven to mark it.

The points located in this manner are the theoretical points, and the actual points will be behind the theoretical points a distance in inches equal to one-half the frog number. This method will not work on curved tracks. The string method can also be used when the frogs are not of the same number and where the tracks are not parallel, but the explanation is too long to be given here.

Has Followed This Rule

By L. J. Gilmore
Division Roadmaster, Great Northern, Superior, Wis.

Here is a rule I have followed for years and have always found it satisfactory:

From the distance between the gage lines of the two tracks, subtract standard gage, 4 ft. 8½ in., and multiply the remainder by the frog number of the frogs that are to be used. This will give the distance between the frog points for the crossover. This rule is equally applicable whether the tracks are straight or curved, so long as they are parallel. If the frogs are not of the same number, one must use the mean of the two numbers.

Gives a Short Rule

By J. H. Guest
Roadmaster, Missouri-Kansas-Texas, Woodward, Okla.

If the tracks are straight and the frogs are of the same number, the distance in feet between the actual points of frogs, measured along the crossover, is easily obtained by the formula

$$L = N(p - 9.5)$$

in which L is the distance desired, N is the frog number, p is the perpendicular distance between center lines of the tracks. The numerical 9.5 is obtained by taking twice the gage and adding the width, in feet, of the actual frog points.

When Bridge Pins Become Worn

Where the pins of a pin-connected bridge become worn, what methods can be employed to take up the slack or otherwise overcome the condition?

Bridges Usually Light

By Inspector of Bridges

Bridges that get in the condition mentioned in the question are generally old, light structures; that is, they are carrying loadings well in excess of the design loads, while many of them are approaching the limit of their service life. For these reasons, it seldom pays to go to any great expense to correct the trouble. As a matter of fact, it is often better to replace the structure with one of modern design than to spend any money in an effort to carry it longer.

If the structure is suitable for use on a line of lighter traffic it will be possible to ream the pin holes when it is dismantled and use larger pins when it is re-erected. I am told that it is possible to ream the holes and drive larger pins while the bridge remains in service, but I have never seen it done. In any event this would be a difficult and expensive operation which, I feel quite sure would not be warranted on any structures of the type in question which have come under my observation.

I know of one instance where U-bars were employed to relieve the bearing of eye-bar members of the lower chord and laterals of their bearing against pins that were becoming rather badly worn. To relieve the bearing of compression members, obviously the opposite course would be necessary, that is, the device would have to be in the form of a wedge or strut. My own belief is, however, that when pins and pin holes become so badly worn that action is necessary it will be better to replace the structure with one capable of sustaining a higher loading.

Pin Holes Also Wear

By Engineer of Bridges

Two things must be kept in mind when considering this question. The first is that it requires very little wear to create looseness in a bridge member, and the other is that when wear occurs on the pin an equal or greater amount of wear can be expected in the pin holes. Furthermore, wear in the pin holes is not uniform around the

circumference, but takes place over the area of the bearing, thus producing an oblong hole. Again, the greatest wear occurs in those members subject to reversal of stress, so that the pin holes in these members become out of round on diametrically opposite sides, thus increasing the oblong effect. At the same time no wear, or an amount so small as to be negligible, may occur on the area of no bearing, that is on that point of the circumference lying at right angles to the worn areas.

As this wear is taking place in the pin holes, corresponding wear which decreases the size of the pin is occurring. As the intensity of the stresses in the different members, and therefore of the bearing of these members on the pin is not uniform, and as all members are not subject to reversal of stresses, the wear on the pin is not uniform, and as all members are not subject to reversal of stresses, the wear on the pin is not uniform. The result is zones of light and heavy wear, with sharp shoulders at the lines of demarcation. In fact, I have seen cases of wear where it was extremely difficult because of these shoulders, to drive the pins out when dismantling structures, even after the pin had been relieved of all stress.

Obviously, because of this lack of uniformity in the wear of the pin holes, it will be of little use to remove the worn pin and replace it with one of full section, although occasionally this will be of enough benefit to warrant the effort. Probably the best scheme to follow is to use some device which will pull or crowd the pin against one side of the hole in such a manner as to prevent it coming into contact with the area which has been receiving the greatest wear. This has been accomplished successfully in a number of cases through the use of loop rods on tension members and resort to wedges on compression members. This leaves the pin in place and will care for the condition for several years, the period, of course, depending on the amount of traffic and the ratio of actual loading to the design loads. The details will depend on the design of the structure.

What Stock Should They Carry?

What stock of materials should a building gang carry on its supply cars?

Men in Field Know Best

By J. P. Wood

Supervisor Bridges and Buildings, Pere Marquette, Grand Ledge, Mich.

So many conditions, including the character and volume of the work, accessibility of stores and willingness of the stores department to carry items used infrequently, affect this question that no hard and fast rule can be applied. In the main, however, one is safe in saying that the men in the field are better able to judge what should be carried, than others who are not intimately in touch with the work.

A supervisor must always be on his guard to counteract the tendency to accumulate a stock in excess of what is reasonably needed. It takes only a few experiences of delay in obtaining much-needed material to convince the average foreman that he should be better fortified next time. If the district to which the gang is assigned is distant from stores headquarters, it may be necessary to carry larger quantities of certain items than would otherwise be necessary. If there is a storehouse at or near the supervisor's headquarters, he may be able to hold the traveling stock to a very low point and still not risk delaying any of the routine work of the gang.

A foreman assigned to a specific territory soon learns the requirements of the structures under his care, and knows what the normal demands are for emergency work and the routine small jobs that are continually turning up unexpectedly. If these requirements are met, this is about all of the stock he will need, except nails, a generous supply of which should be on hand at all times.

A small supply of stove pipe and elbows should be carried, especially during the fall and winter. Roofing near the end of its life is likely to be damaged by high winds. For this reason, a stock of two or three rolls of roofing will often save more than its cost by allowing repairs to be made before the building or its contents are damaged. A small stock of lumber in the sizes most frequently used, particularly those sizes required for platforms, is almost a necessity if the gang is to function as it should. Other items include bolts, hinges, hasps, staples, locks, flat-headed wood screws, one or two door checks, glazier's points, putty, certain standard paints with a small quantity of oil and turpentine, a few pounds of No. 9 wire, a few sacks of cement, sand and gravel, and one sack of hydrated lime.

Supervisor Must Arbitrate

By Supervisor of Bridges and Buildings

This is a question often discussed yet never settled, largely because there are three points of view, those of the general officer, the supervisor and the foreman. The general officer is rarely in sufficiently intimate contact with the routine work of the gang to judge intelligently of its needs, and he is sure that too much stock is being carried. The foreman, on the other hand, often bases his attitude on the difficulty he has experienced so often in obtaining promptly the material needed for his routine work, and since he usually must order this in small lots he wants a stock large enough to counteract delays in shipping what he needs.

This makes it more definitely the responsibility of the supervisor to see that the gang does not carry an excess stock of any material or a stock of material it will not ordinarily need. That is, a gang engaged in repairing enginehouses and shops will seldom need door checks or cabinet hardware, while a gang doing house carpentry does not need steel cable or large bolts. In other words, he must be sure that items that are not needed are not carried but that what is needed for routine jobs is kept on hand in sufficient quantity to insure against delay to the work or later necessity of sending part of the gang back to finish work for which material was lacking at the time the work was done.

It is impracticable to present a standardized list of material which a building gang should carry, since the work on different districts and even between gangs on a given district or division may vary widely, so that their material requirements may vary over an equally wide range. This is a matter that must be determined after consideration of all of the factors involved. Even where full consideration is given, the requirements during one part of the season may be very different from those at an earlier or a later date. The best rule is to provide the gang with what it needs and be sure that it is not provided regularly in excess of those needs.

News of the Month

Proposes Water Carrier Regulation

A bill providing for the regulation of water carriers by the Interstate Commerce Commission has been introduced in Congress by Representative Ramspeck of Georgia. The bill was drafted by Joseph B. Eastman, a member of the Interstate Commerce Commission and former coordinator of transportation.

Begins Publication of Motor Truck Tonnage

American Trucking Associations, Inc., has begun publication of a series of monthly surveys of truck loadings, based on reports from leading motor carriers. The first survey was issued for the month of January and was based on reports from 128 carriers operating in 32 states, which transported 220,322 tons of freight during the month. This compares with the 1936 monthly average freight loading, of 215,521 tons. The January, 1937, loading represents an increase of 2.2 per cent over the 1936 monthly average. It was pointed out that this increase was made despite unsettled labor conditions throughout the country and the general cessation of business in the middle western flood area. It was also reported that in many sections the first month of the year is usually a lean one as far as the movement of freight is concerned.

Railway Net Income Shows Upturn in 1936

The Class I railroads of the United States had a net railway operating income in 1936 of $665,479,894, or a return of 2.57 per cent on their property investment, as compared with a net railway operating income of $497,359,578, or 1.92 per cent, in 1935, according to reports compiled by the Bureau of Railway Economics of the Association of American Railroads. Operating revenues in 1936 totaled $4,043,915,602, as compared with $3,443,510,112 in 1935, while operating expenses in 1936 amounted to $2,925,127,071, as compared with $2,587,463,311 in 1935. Nineteen Class I railroads failed to earn expenses and taxes in 1936.

In December the net railway operating income of the Class I carriers was $68,742,292, an increase of 54.9 per cent as compared with December, 1935. Total operating revenues for December amounted to $363,446,431, an increase of 25.6 per cent, while expenses, taxes and rents amounted to $294,704,139, an increase of 20.3 per cent.

The foregoing figures do not include those of the Louisville & Nashville for December of each year because recent flood conditions delayed that road in compiling its report for 1936.

Santa Fe Completes Denver-Texas Cut-Off

On February 4 the Atchison, Topeka & Santa Fe inaugurated train service over a new 112-mile line extending generally in a north and south direction between Boise City in the Oklahoma Panhandle and Las Animas, Colo., which line comprises the final link in this company's Denver-Texas cut-off. The first link in this cut-off, which was completed in 1931, extends between Amarillo, Tex., and Boise City, a distance of approximately 110 miles. Prior to the completion of these lines the shortest distance between Amarillo and Denver, via Santa Fe lines was 816 miles. The distance between these points over the cut-off is 442 miles, or 374 miles less than formerly.

The grading of the Boise City-Las Animas portion of the cut-off was started on May 6, 1936, and track laying was completed on December 17. It involved the construction of 110.5 miles of new main track, 5.6 miles of sidings, 61 pile trestles, totalling 5,300 ft. in length, two deck-plate girder structures on concrete piers and abutments, and various auxiliary facilities. The grading of the line entailed 3,000,000 cu. yd. of embankment and 1,330,000 cu. yd. of excavation in cuts. Most of the grading was done on the "waste and borrow" basis.

Rules for Spending Grade Crossing Funds

The terms under which the states can share in the $50,000,000 federal fund for continuing through the next fiscal year on a permanent basis the program of eliminating hazards at railroad grade crossings were announced by the secretary of agriculture on February 12. These funds, authorized by the act of Congress of June 16, 1936, were apportioned among the various states by the secretary on December 29, and become available for expenditure on July 1. Five types of grade crossing elimination and protection developments are eligible: (1) Separation of grades at crossings; (2) installation of protective devices at grade crossings; (3) reconstruction of existing grade separation structures; (4) relocation of highways to eliminate grade crossings; and (5) relocation of railroads to eliminate grade crossings. To insure a fair distribution of benefits among the railroads in each state, the regulations require that improvements shall be divided among the various railroads so that the amount expended on each shall be approximately in proportion to its mileage. On each railroad crossings of the greatest hazard to traffic are to be selected for elimination or protection. Initiative in selecting projects for improvement rests with the state authorities who will prepare programs, and submit them to the Bureau of Public Roads for approval.

Air Conditions Banana Warehouse

By means of air-conditioned store rooms in a banana warehouse which the Baltimore & Ohio recently constructed at Pittsburgh, Pa., it is posible to hold bananas indefinitely under ideal conditions of temperature and humidity, and to ripen them slowly or rapidly as desired, under conditions best suited to preserve their quality and to bring out their best flavor. The warehouse contains 16 banana storage rooms, each of which is 36 ft. long, 12½ ft. wide and 11 ft. high and is insulated with 3 in. of corkboard. Each of the storage rooms is equipped with an independent air-conditioning unit, of the latest York type, whereby the condition of the air in each room can be controlled independently of that in any of the other rooms. The air-conditioning system in each room includes cooling coils and steam- heating coils for temperature control, water sprays for humidity control, and fans for assuring the proper ventilation. Automatic control of the temperature and humidity is secured through the use of thermostats and humidistats.

Trucking in United States

The sum of $530,860,000 was received by 61,216 motor trucking companies in the United States in 1935, according to data compiled by the Bureau of Census, United States Department of Commerce. These companies reported an average of 158,283 persons on their pay rolls during that year, and a total pay roll of $179,485,000. They operated 188,809 vehicles in October, 1935, including semitrailers and tractors as separate vehicles but excluding stand-by equipment. Of these companies 74.6 per cent were engaged primarily in local operations, 16.7 per cent in intrastate, and 8.7 per cent in interstate trucking. In terms of annual revenue, interstate operators accounted for 36.9 per cent of the total. Almost one third (31.9 per cent) of all the companies received less than $1,000 per year, but these companies accounted for only 2.0 per cent of the total revenue. A total of 904 companies, or 1.5 per cent of the number reporting, had annual revenues amounting to $100,000 or more and these companies accounted for 45.8 per cent of all trucking revenues while 274 companies received $250,000 or more per year, and 96 companies earned $500,000 or more per year.

Personal Mention

General

Dudley O. Stone, assistant right-of-way agent of the Gulf, Colorado & Santa Fe, with headquarters at Galveston, Tex., has been promoted to right-of-way agent.

V. J. Bedell, chief engineer of the New Orleans Public Belt, New Orleans, La., has been elected also general manager of this company, succeeding **A. F. Barclay,** whose death is noted elsewhere in these columns.

E. A. Whitman, general manager of the Minneapolis, St. Paul & Sault Ste. Marie with headquarters at Minneapolis, Minn., and formerly chief engineer of this company, has been appointed also vice-president, effective March 1.

Herbert W. Faus, engineer of tests of the New York Central, who spent many years in the engineering departments of various railroads, has been appointed engineer of motive power of the New York Central System, with headquarters at New York. Mr. Faus was born on July 28, 1886, at Munsey Valley, Pa., and was graduated from Syracuse university in 1910 with a

Herbert W. Faus

degree in civil engineering. He entered railroad service in 1910 and served until 1912 as rodman, leveler, transitman, bridge inspector and bridge engineer with the Canadian Northern (now the Canadian National) in Ontario and British Columbia. From 1912 to 1915 he was resident engineer of the Kettle Valley (now part of the Canadian Pacific) at Hope, B. C., and Penticton, B. C., and from 1915 to 1917 he was special engineer of the New York Central Lines at New York. From 1917 to 1923, he served as office engineer, plant engineer, resident engineer and chief administrative officer, successively, for the U.S. Shipping Board, Emergency Fleet Corporation, Bristol, Pa. From 1923 to 1926, Mr. Faus served as special engineer and engineer material and equipment tests with the New York Central, and in 1926 he was appointed engineer of tests, which position he held until his recent appointment.

C. D. Merrill, division engineer on special duty in the office of the chief engineer of the Pennsylvania, with headquarters at Philadelphia, Pa., has been appointed superintendent of the Wilkes-Barre division at Sunbury, Pa. Mr. Merrill was born at Sullivan, Ind., on July 12, 1901, and was graduated from Purdue

C. D. Merrill

University. He entered the service of the Pennsylvania on March 14, 1925, as an assistant on the engineer corps, and was appointed assistant supervisor on the For Wayne division on August 16, 1928. On January 5, 1931, he became supervisor of track at Wilkes-Barre, Pa., and on July 24, 1933, he was transferred to West Philadelphia, Pa. Mr. Merrill was assigned to the office of the vice-president in charge of traffic as division engineer on November 16, 1935, and on January 1, 1937, he was transferred to the office of the chief engineer at Philadelphia as division engineer on special duty. Mr. Merrill's appointment as superintendent of the Wilkes-Barre division became effective on February 1.

William J. Whalen, assistant superintendent on the Chicago, Milwaukee, St. Paul & Pacific, and formerly a roadmaster on this road, has been promoted to superintendent at Terre Haute, Ind. Mr. Whalen has been in the service of this company for nearly 31 years. He was born on March 22, 1893, at Lansing, Iowa, and, beginning in 1906, he served during summer vacation periods as a water boy on maintenance gangs. In 1909 he entered the service permanently and held the positions of timekeeper, assistant extra gang foreman, section foreman and extra gang foreman until August 8, 1916, when he was promoted to roadmaster, serving on the Dubuque and Illinois divisions. From September 1, 1923, to November 1, 1926, he served as trainmaster and roadmaster at Joliet, and from November 1, 1926, to September 1, 1934, he held the position of trainmaster successively at Montevideo, Minn., Aberdeen, S. D., Portage, Wis., and Dubuque, Iowa. At the end of this period he was advanced to assistant superintendent at Perry, Iowa, which position he was holding at the time of his recent promotion to superintendent, with headquarters at Terre Haute, which was effective on February 1.

Engineering

Charles L. Bates, engineer maintenance of way of the Pacific Great Eastern with headquarters at Squamish, B. C., has been promoted to the newly-created position of chief engineer of this company.

C. H. Brodbeck, division engineer of the Paducah & Memphis division of the Nashville, Chattanooga & St. Louis, with headquarters at Nashville, Tenn., has been promoted to senior assistant engineer of that railway, with the same headquarters. **J. M. Ryan,** division engineer of the Nashville division, has had his jurisdiction extended to include the Paducah and Memphis division. These changes became effective on February 1.

E. L. Haley has been appointed division engineer on the Chicago, Burlington & Quincy with headquarters at Casper, Wyo., to succeed **J. S. Findley,** who has been transferred to Denver, Colo., where he replaces **H. A. Aalberg,** who has been appointed assistant chief engineer at Lincoln, Neb. A sketch and photograph of Mr. Aalberg are presented elsewhere in this column. **C. F. Sturdevant** has been appointed division engineer, with headquarters at Alliance, Neb., to succeed **R. C. Pearson,** deceased.

Henry A. Aalberg, who has been appointed assistant chief engineer of the Chicago, Burlington & Quincy, Lines West of the Missouri river, with headquarters at Lincoln, Neb., as reported in

Henry A. Aalberg

the February issue, has been in the service of this company for more than 26 years. He was born on September 6, 1887, at Minneapolis, Minn., and received his engineering education at Highland Park college, Des Moines, Iowa. Mr. Aalberg entered railway service with the Burlington on May 16, 1910, serving as a field draftsman, topographer and levelman on location in Wyoming, Colorado and Montana. In September, 1911, he was sent to the office of the assistant chief engineer at Lincoln as a draftsman, where he remained until March, 1912, when he was transferred to the McCook division at Denver, Colo., as an instrumentman on maintenance. In June, 1916, Mr. Aalberg was promoted to division engineer of the Lincoln division with headquarters at Lincoln, remaining in this position until

June, 1922, when he was made chief of a locating party in Wyoming. In November of the same year Mr. Aalberg returned to the Lincoln division as division engineer, being transferred to the McCook division, with headquarters at Denver, in February, 1923. He remained at that point as division engineer until his recent promotion to assistant chief engineer, effective February 1.

M. D. Carothers, assistant engineer maintenance of way of the Baltimore & Ohio Chicago Terminal, has been appointed division engineer of the Eastern division of the Alton, with headquarters at Bloomington, Ill., to succeed **A. F. Kadow,** who has been appointed to succeed Mr. Carothers as assistant engineer maintenance of way of the B. & O. C. T.

P. McKay, assistant district engineer of the Lake Erie & Western district of the New York, Chicago & St. Louis, with headquarters at Frankfort, Ind., has been appointed division engineer on the Nickel Plate district, with headquarters at Fort Wayne, Ind., to succeed **H. M. Hockman,** who has been transferred to the Clover Leaf district with headquarters at Frankfort, to replace **F. R. Ramsey,** who has retired. **W. E. Cornell,** chief draftsman at Cleveland, Ohio, has been appointed division engineer on the Nickel Plate district, with headquarters at Conneaut, Ohio, to succeed **W. Sprague,** who has retired. **H. F. Whitmore** has been appointed assistant district engineer at Frankfort, to succeed Mr. McKay.

Raymond Swenk, who has been appointed chief engineer maintenance of way of the Central region of the Pennsylvania, with headquarters at Pittsburgh, Pa., as

Raymond Swenk

reported in the February issue, was born on January 3, 1886, at Sunbury, Pa., and was graduated from Pennsylvania State College in 1907. In June of that year, he entered the service of the Pennsylvania as a rodman on the engineering corps of the Sunbury division, and in 1909 he was transferred to the Conemaugh division. In 1913, Mr. Swenk was advanced to transitman in the office of the chief engineer maintenance of way, and a year later he was promoted to assistant supervisor, in which position he served successively on the Delaware, Atlantic and Philadelphia Terminal divisions. After four years, he was further advanced to supervisor on the Schuylkill division, with headquarters at Norristown, Pa., later being transferred to the Philadelphia division at Middletown, Pa., and then to Paoli, Pa. In February, 1927, Mr. Swenk was promoted to engineer maintenance of way of the Southern division, with headquarters at Wilmington, Del. He was transferred to the operating department in June, 1928, as division superintendent serving in this capacity and as general superintendent until his promotion to chief engineer maintenance of way of the Central region.

William R. Gillam, whose appointment as district engineer of the Southern lines of the Illinois Central system, including the Yazoo & Mississippi Valley and the Gulf & Ship Island, with headquarters at New Orleans, La., was noted in the February issue, has been identified with the I.C. for 38 years. Mr. Gillam's first service with this company was as an engineer apprentice on the former Chicago division. He served in this capacity and

William R. Gillam

as a rodman and assistant engineer at various points until April 21, 1906, when he was advanced to resident engineer on construction. On May 19, 1907, he was made assistant engineer on construction at Baton Rouge, La., being transferred to the Memphis division on August 15 of the same year. On September 1, 1915, Mr. Gillam was promoted to assistant engineer in the valuation department and on December 10, 1916, he became a track supervisor on the Memphis division. On February 8, 1921, he was appointed assistant engineer, serving in this capacity in the maintenance of way department, in the chief engineer's office and in grading work on the lake front at Chicago. On May 1, 1923, Mr. Gillam was appointed assistant roadmaster on the Chicago Terminal division and on February 1, 1925, he was advanced to roadmaster of the Springfield division, being transferred to the St. Louis division on March 1, 1929. On October 1 of the same year he was promoted to district engineer of the Northern lines and on September 21, 1931, following a consolidation of territories he was appointed division engineer with headquarters at Waterloo, Iowa, which position he was holding at the time of his recent promotion to district engineer at New Orleans.

W. F. Hart, roadmaster on the Union Pacific at Rawlins, Wyo., has been promoted to division engineer of the newly-created Utah division with headquarters at Pocatello, Ida. Mr. Hart has been identified with the Union Pacific for about 18 years. He was born on January 8, 1894, at Aberdeen, S. D., and attended the engineering college of the University

W. F. Hart

of Nebraska. He entered the service of the Union Pacific on June 19, 1916, as an instrumentman, serving in this capacity and as a building inspector until March, 1918, when he joined the United States Army. In August, 1919, he returned to the Union Pacific as a general foreman, holding this position until February, 1920, when he was appointed an assistant engineer at Grand Island, Neb. A year later he was made an instrumentman at Grand Island, and in April, 1924, he was reappointed to the position of assistant engineer with the same headquarters. In May, 1928, Mr. Hart was made a roadmaster, serving in this capacity at Kearney, Neb., and Columbus until November, 1931, when he was assigned to the valuation department at Omaha, Neb. He was reappointed to the position of roadmaster in July, 1933, serving in this capacity at Salina, Kan., Marysville, Kan., and Rawlins, Wyo., until his recent promotion to division engineer, which was effective on February 1.

Track

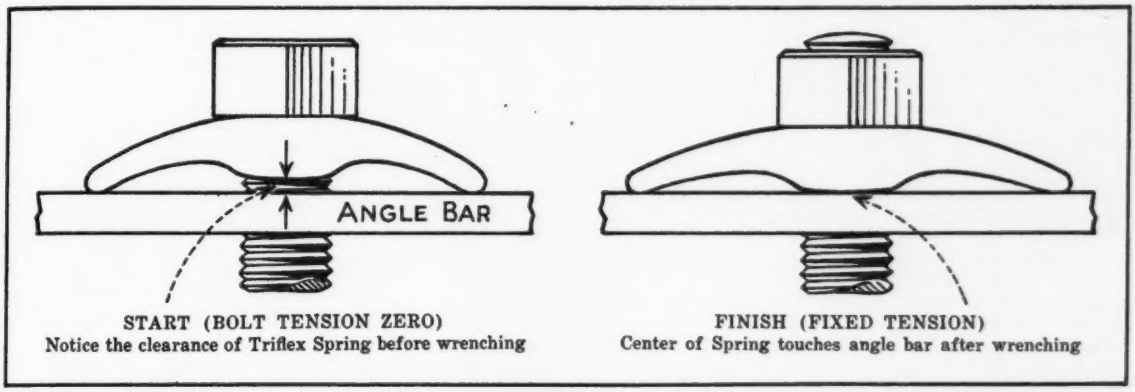
Frank C. Welch, track supervisor on the St. Paul division of the Northern Pacific, has been appointed acting roadmaster, with headquarters at Minneapolis, Minn., to succeed **George W. Minkel** who has been granted a leave of absence.

T. W. Porter, an extra gang foreman on the Chicago, Milwaukee, St. Paul & Pacific with headquarters at Othello, Wash., has been promoted to roadmaster with the same headquarters, to succeed **A. M. Anderson,** whose death is noted elsewhere in these columns.

B. O. Webb has been appointed track supervisor on the Paducah & Memphis division of the Nashville, Chattanooga & St. Louis, with headquarters at Jackson, Tenn., to succeed **Otto Joslin,** who has

VERONA *Fixed Tension* TRIFLEX SPRING

A simple and visible means of establishing and maintaining uniform bolt tension



START (BOLT TENSION ZERO)
Notice the clearance of Triflex Spring before wrenching

FINISH (FIXED TENSION)
Center of Spring touches angle bar after wrenching

VERONA FIXED TENSION TRIFLEX SPRING is designed and perfected to provide clearance between the center of the spring and the face of the angle bar before the bolt is tightened. A complete turn of the nut increases the bolt tension from zero to the FIXED tension and brings the center of the Triflex Spring in contact with the face of the angle bar.

When the center of the spring contacts the angle bar a resistance is instantly felt. This is known as the STICK POINT. It is not necessary to watch the spring to establish this point. STICK POINT is instantly felt and recognized and there is no tendency to carry the wrenching beyond this point. This STICK POINT is evident either in hand wrenching or where mechanical bolt-tighteners are used. By a careful process of manufacture and heat treatment we are able to produce these Springs with less than 5% variation from the FIXED TENSION.

VERONA FIXED TENSION TRIFLEX SPRING is the only device of its kind geared high enough to provide sufficient bolt tension without going flat and at the same time establish equal tension in all bolts. Triflex Spring depends purely on tension for such registration and is far more accurate than the use of calibrated wrenches, which attempt to convert a friction registration into tension.

The establishment of equal and proper tension in all track bolts is equally as important—if not more important—than high reactive spring pressure. Such equal tension will eliminate frozen joints, which, in turn, will eliminate running expansion and contraction, preventing broken bolts in the Winter and buckling track in the Summer. Equal bolt tension in all joints will also permit the better functioning of Rail Anchors under all climatic conditions.

SINCE 1873

WOODINGS–VERONA TOOL WORKS VERONA, PA.

SINCE 1873

You are invited to our Booths at the National Railway Appliances Exhibit, Coliseum, Chicago, Mar. 15-18

been promoted to bridge and building supervisor of the Nashville and the Paducah & Memphis divisions, as noted elsewhere in these columns.

Oren Stewart, a track foreman on the Illinois Central, has been promoted to supervisor of track of the Bluford district, with headquarters at Reevesville, Ill., to succeed **G. J. Willingham,** who has been assigned to transportation duties.

Charles A. Williams, acting roadmaster on the Atchison, Topeka & Santa Fe at Carlsbad, N. M., who has been appointed roadmaster with the same headquarters as reported in the February issue of *Railway Engineering and Maintenance,* has been identified with the Santa Fe for more than 17 years. He was born on March 16 1898, at Fulton, Kan., and received his higher education at the University of Kansas. He entered railway service with the Santa Fe in September, 1919, as a rodman, holding this position until June, 1922, when he was advanced to transitman. In April, 1923, Mr. Williams was appointed as assistant extra gang foreman, returning to the position of transitman in August of the same year. In September, 1927, he was advanced to office engineer at Clovise, N. M., and two years later he was promoted to roadmaster at San Angelo, Tex., returning to Clovis as office engineer in September, 1930. In August, 1936, Mr. Williams was appointed acting roadmaster at Carlsbad, where he remained until his recent appointment as roadmaster, with the same headquarters.

Bridge and Building

Otto Joslin, track supervisor on the Nashville, Chattanooga & St. Louis, with headquarters at Jackson, Tenn., has been appointed bridge and building supervisor of the Nashville and the Paducah & Memphis divisions, with headquarters at Nashville, Tenn.

Obituary

A. M. Anderson, roadmaster on the Chicago, Milwaukee, St. Paul & Pacific with headquarters at Othello, Wash., died on February 8.

Edward W. Smith, who retired on March 16, 1931, as assistant to the chief engineer of the Seaboard Air Line, died at Norfolk, Va., on February 13 following a short illness. He was 78 years old.

Elmer H. Olson, asistant engineer on the Atchison, Topeka & Santa Fe with headquarters at Chicago, died of pneumonia on February 19. Mr. Olson had been connected with the Santa Fe for more than 37 years.

A. F. Barclay, who resigned as general manager of the New Orleans Public Belt on January 1, died at New Orleans, La., on January 31 at the age of 58 years. Mr. Barclay first became connected with the New Orleans Public Belt in 1906, serving as civil engineer and assistant engineer until 1912. After a period of service with the Texas & Pacific he returned to the New Orleans Public Belt as chief engineer, which position he held until 1934, when he was promoted to general manager, resigning on January 1, 1937.

Andrew Lahey, supervisor of track on the Portland division of the Boston & Maine, with headquarters at Lawrence, Mass., died on February 1, at the age of 50 years. Mr. Lahey entered the service of the Boston & Maine as a trackman in April, 1904, and some years later was promoted to assistant foreman and then to foreman. On May 1, 1929, he was promoted to supervisor of track.

Edward L. Crugar, chief engineer of the Wabash, died at St. Louis, Mo., on March 2 following a long illness. Mr. Crugar had been identified with various railroads in engineering capacities for nearly 35 years. He was born on November 4, 1879, at Saline City, Mo., and was educated at Pritchett college and the University of Wisconsin. During summer vacations he served as a chairman and later as a rodman and masonry inspector on the Chicago & Alton. In April, 1902, he was appointed chief clerk to the chief engineer of the Knoxville, Lafollette & Jellico (now part of the Louisville & Nashville), and until March, 1906, he served in this position and as resident engineer and asistant engineer on the same road. At the end of this period Mr. Crugar returned to the Alton as chief clerk to the chief engineer, being advanced to assistant engineer in charge of construction two years later. In 1910, he was further advanced to asistant chief engineer, with headquarters at Chicago, holding this position until April, 1915, when he left the Alton to acept a position as assistant enginer on the Illinois Central, being promoted to district engineer, with headquarters at New Orleans, La., in December, 1915. Holding this position until the latter part of 1923, Mr. Crugar was then promoted to engineer of construction, with headquarters at Chicago. In 1931 he left the Illinois Central to become chief engineer of the Wabash with headquarters at St. Louis, where he remained until his death.

Edward L. Crugar

E. O. Reeder, who retired in 1917 as assistant chief engineer of the Western lines of the Chicago, Milwaukee, St. Paul & Pacific, died at Seattle, Wash., on February 21 in his eighty-sixth year. Mr. Reeder entered the service of the Milmaukee in 1875 as a crosstie and wood inspector, later being transferred to the engineering department, where he was engaged on surveys and on branch-line construction in Wisconsin, Iowa and Minnesota. In 1901, he was appointed assistant chief engineer and in 1911 chief engineer of the Chicago, Milwaukee & Puget Sound (part of the Milwaukee). Following the consolidation of the C. M. & P. S., with the parent line in January, 1913, he was appointed assistant chief engineer in charge of the Western lines.

Harold F. Lane, Washington editor of *Railway Engineering and Maintenance,* the Railway Age and other magazines published by the Simmons-Boardman Publishing Corporation, died at his home at Washington, D.C., on February 28 of heart disease. Mr. Lane was born on November 2, 1882, at Ashburnham, Mass., and was educated at Dartmouth college, graduating with the class of 1905. He entered the employ of the Railway Age in 1905 and was appointed an associate editor in the following year. Shortly thereafter he became associate editor of the Electric Railway Review, in which capacity he remained until 1908, when he went with the Chicago Tribune as railroad editor. Returning to the Railway Age in 1911, Mr. Lane served as asociate editor at Chicago until 1916, when he was made Washington editor, the position he held until his death.

Association News

Wood-Preservers' Association

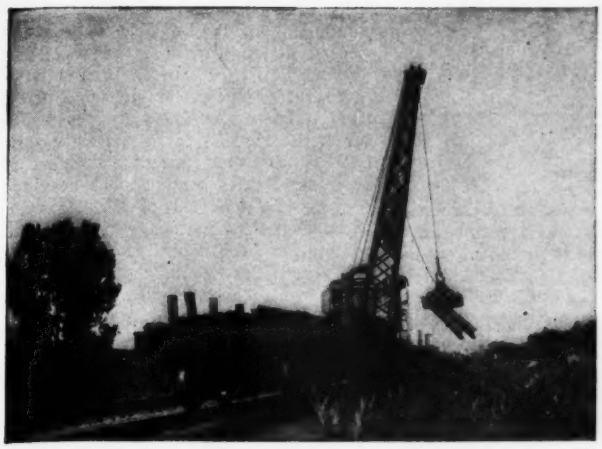
President H. R. Duncan has called a meeting of the executive committee of this association at the Palmer House, Chicago, on Friday, March 19.

International Railway Maintenance Club

A meeting of the club held during the afternoon of February 25, at the Hotel Statler, Buffalo, N.Y., was addressed by Gordon Wilson, automotive engineer of the New York Central, who discussed locomotive development and testing from the standpoint of their relation to the track structure.

Roadmasters' Association

In addition to the four committees whose personnel was published in the February issue of *Railway Engineering and Maintenance,* President Haley has appointed a committee to report on The Operation of Motor Cars to Avoid Accidents as follows: M. Canavan (chairman), gen. rdm., U. P., Kansas City, Mo.; C. E. Morgan (vice-chairman), supt. work equip., C. M. St. P. & P., Chicago; A. W. Applequist, rdm., Soo Line, Bismarck, N. Dak.; R. F. P. Bowman, rdm., C. P. R., Lethbridge, Alta.; J. P. Corcoran, supvr., Alton, Bloomington, Ill.; L. M. Denney, supvr., C. C. C. & St.



Burro Crane Equipped with Ohio Magnet Loading Changed Out Rails, Two or More Lengths at a Time

20′ Ohio Magnet on Tractor Crane Handling Axle Forging

OHIO LIFTING MAGNETS

Carried by various types of cranes are doing many different kinds of work for railroads more economically than it could be done by any other means.

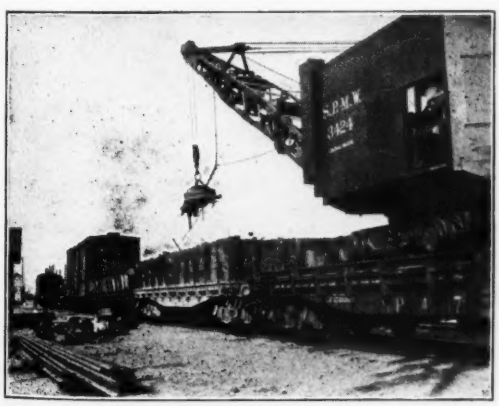
They handle scrap in yards—load and unload rails and track fastenings in storage yards and out on the line.

It is a little used magnet which does not save its price in labor cost, in six months time.

Inquire of Ohio or through your crane builder.

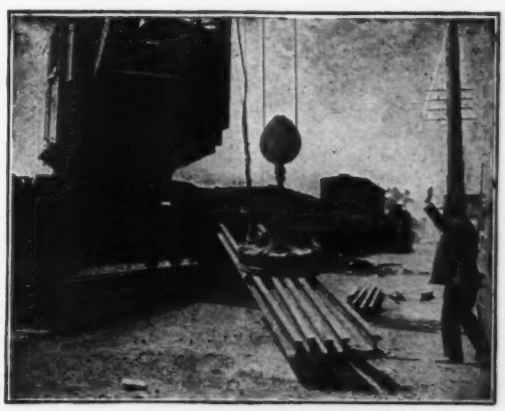
The Ohio Electric Mfg. Co.

5905 Maurice Ave. **Cleveland, Ohio**



36′ Ohio Magnet on Locomotive Crane Loading Scrap

Ohio Reliable Lifting Magnets



A 36′ Ohio Handling Rails for Stores Department on the Southern Pacific R. R.

L., Indianapolis, Ind.; C. S. McConnell, rdm., C. & N. W., Manitowoc, Wis.; J. M. Miller, supvr., W. M., Westminster, Md.; C. E. Schoenfield, rdm., C. B. & Q., Aurora, Ill.; R. W. Putnam, rdm., S. P., Oakridge, Ore.; J. A. Spurlock, rdm., M. K. T., Muskogee, Okla.; F. W. Triplett, supvr., Penna., Chicago; E. W. Walch, rdm., C. & N. W., Green Bay, Wis.; M. H. Murphy, supvr., Alton, Slater, Mo.; R. J. Yost, rdm., A. T. & S. F., Chillicothe, Ill.

The proceedings of last September's convention are now in type and it is expected that they will come from the printer in time to be distributed to members during this month.

Bridge and Building Association

Members of the association in attendance at the A.R.E.A. convention will meet for lunch in Chicago on March 17 at a place to be announced at the convention. Following the luncheon members of the executive committee will meet at the Palmer House to review the work of the committees and to transact other business. The proceedings of the last annual convention are now in the hands of the printer and will be distributed to the members sometime during the month of March.

Maintenance of Way Club of Chicago

Sixty members and guests were present at the meeting on March 1, when C. E. Morgan, supervisor of work equipment and welding, Chicago, Milwaukee, St. Paul & Pacific and R. E. Buss, superintendent of work equipment, Illinois Central, discussed the operation and upkeep of work equipment. Each of the speakers reviewed the practices and policies followed on his road, and their remarks were actively discussed from the floor. The next meeting will be held on Wednesday, March 29.

Metropolitan Track Supervisors Club

More than 50 members and guests were in attendance at the last meeting of the club, on February 11, at the Hotel McAlpin, New York City, when consideration was given to the subject of methods of improving the service of rails. The meeting was addressed by C. B. Bronson, inspecting engineer of the New York Central System, who described briefly recent developments in rail manufacture, and then gave more detailed consideration to those practices and methods being employed to prolong the life and improve the service condition of existing rails in the track. Mr. Bronson's remarks were followed by more than an hour's discussion of the subject.

Power Pumps—A 12-page illustrated bulletin has been issued by Fairbanks, Morse & Company, Chicago, which contains detailed descriptions of this company's standard general service and heavy-duty duplex power pumps. The bulletin contains line drawings and tables giving the principal dimensions, sizes and capacities of the pumps.

Supply Trade News

Personal

J. L. McCaffrey, manager of domestic sales of the **International Harvester Company,** Chicago, has been promoted to director of domestic and Canadian sales, and has been succeeded by **W. F. McAfee,** manager of domestic motor truck sales, who in turn has been succeeded by **P. V. Moulder,** assistant manager of the Eastern district.

Daniel J. Saunders has been appointed manager of railway and industrial sales of the **Permutit Company,** with headquarters in New York City. Mr. Saunders, who has been with the company for 17 years, was born in New York on August 23, 1897. Following his education in the

Daniel J. Saunders

public schools of New York and at Stevens Institute of Technology, and then service in the U. S. Naval Reserve during the war, he became connected with the U. S. Shipping Board in 1919. He entered the employ of the Permutit Company in February, 1920, as an assistant to the sales manager, and later became a sales representative and then assistant sales manager. He was holding this latter position at the time of his appointment as manager of railway and industrial sales.

H. F. Henriques and **J. J. Lincoln, Jr.,** have been appointed assistant general sales managers of the **Air Reduction Sales Company,** with headquarters at Cleveland, Ohio, and Pittsburg, Pa., respectively. Mr. Henriques has been a member of the sales department since March, 1929, and was manager of the Cleveland district from January, 1934, until he assumed his new position in January, 1937. Mr. Lincoln joined the company in 1924 and was appointed manager of the Pittsburgh district in May, 1934. **J. M. Driscoll** has been appointed acting manager at Cleveland. He has been in the service of Airco since March, 1929, when he joined the sales department. In 1933 he was promoted to assistant sales manager of the Cleveland district, which position he has held until his recent appointment. **S. D. Edsall** has been appointed acting district manager of the Pittsburgh district. He has been with the Airco sales department since February, 1923, and has been asistant sales manager of the Pittsburgh district since July, 1925. **J. F. Pryor,** formerly assistant to the general sales manager, has been appointed vice-president of the Magnolia Airco Gas Products Company, a Texas corporation handling all of Air Reduction's activities within that state. Mr. Pryor will have his headquarters at Houston, Texas.

Eugene Brandeis has been elected a vice-president of **Thomas J. Crowley, Inc.,** New York. Mr. Brandeis, who was formerly president of the Lundie Engineering Corporation, will have his headquarters at New York, and will be in charge of track specialty sales. **Wells Martin** has also been elected a vice-president of this company and will be in full charge of the activities of the corporation in the Chicago and northwest territory, with headquarters at Chicago. Mr. Martin is also vice-president and general manager of the Martin Varnish Company, Chicago, and is a member of the executive committee of the National Paint, Varnish and Lacquer Association and past-president of the American Paint and Varnish Manufacturers' Association.

Obituary

Edward M. Sexton, railroad sales manager of Air Reduction Sales Company, died on February 15, in New York, after an illness of several weeks. He was 56 years old. Mr. Sexton was born on

Edward M. Sexton

Staten Island, N. Y., and was educated in the public schools there. He began his career with Air Reduction as a salesman in the New York metropolitan district in 1916. Later he was appointed manager of the Chicago District, and from this position he was transferred back to New York as manager of the metropolitan district. When in 1922 the Davis-Bournonville Company's personnel was merged with that of Air Reduction, he was selected to manage the railroad sales department of Air Reduction, with headquarters at New York.

"THE JORDAN HAS WHAT IT TAKES"

Add up the outstanding features of the "JORDAN" and the sum is a sturdily designed "ALL THE YEAR AROUND MAINTENANCE MACHINE".

Used during spring, summer and fall months as a Spreader, Ditcher, Ballast Plow, Ballast Shaper. During winter months as a Snow Plow, Ice Cutter. Truly an "ALL-THE-YEAR-AROUND MAINTENANCE-MACHINE".

Added flexibility, with lower maintenance than ever before, is built in the JORDAN Standard Composite Spreader-Ditcher.

See this useful Machine at the National Railway Appliances Show, Chicago, March 15th and 18th, inclusive. Or write for Descriptive Circular.

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Walter J. Riley, President

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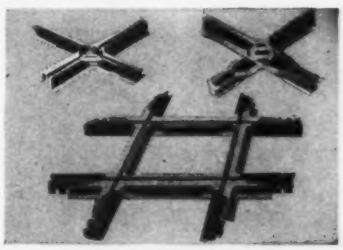

Ask us to send you the record on Wharton Crossings, proving how this scientific design banishes high maintenance and extends life on crossings. Complete information on other Wharton *weldable* special trackwork also available.

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National Lead Company 239
111 Broadway, New York City.
Red Lead.

National Lock Washer Company, The 152
Newark, New Jersey.
Lock Washers; Nut Locks; Spring Washers.

National Railway Appliances Association 174
208 South La Salle St., Chicago, Illinois.
Exhibit of Maintenance of Way Materials and Equipment.

Nordberg Mfg. Co. 148
Milwaukee, Wisconsin.
Adzing Machines; Bolt Tighteners; Power Jacks; Rail Drills; Rail Grinders; Spike Pullers; Track Cranes; Track Shifter; Track Wrenches.

Ohio Electric Mfg. Company, The 227
5905 Maurice Ave., Cleveland, Ohio.
Magnets.

Oxweld Railroad Service Company, The 141
230 No. Michigan Ave., Chicago, Ill.
Acetylene, Dissolved; Calcium Carbide; Gas, Acetylene, Gas Products; Generators, Acetylene, Carbic; Oxygen; Oxy-acetylene, Cutting and Welding Equipment; Torches, Oxy-acetylene Cutting, Welding and Heat Treating.

P. & M. Co. 133
80 East Jackson Boulevard, Chicago, Illinois.
Rail Anchors; Rail Anti-Creepers.

Pettibone-Mulliken Co. 236
4710 W. Division St., Chicago, Illinois.
Crossings, Permanent Base; Mechanical Switchman.

Portland Cement Association 140
33 West Grand Ave., Chicago, Ill.
Cement; Concrete Piles; Precast Concrete; Trestle Deck Slabs.

Rail Joint Co. Inc., The 163
165 Broadway, New York City.
Compromise Joints; Insulated Rail Joints; Rail Joints; Step Joints.

Railroad Accessories Corporation 135
405 Lexington Ave., New York City.
Drills, Rail; Power Track Machine; Tie Boring Machine.

Rails Co., The 240
50 Church St., New York City.
Track Construction; Track Fastenings.

Railway Maintenance Corporation 142
Freeport Road, Pittsburgh, Pennsylvania.
Moles, Ballast Cleaning; Rail Joint Lubricators.

Railway Track-work Co. 233
3132-48 East Thompson Street, Philadelphia, Pennsylvania.
Cross Grinders; Track Grinders.

Ramapo Ajax Corporation 156-157
230 Park Avenue, New York City.
Crossings; Frogs; Guard Rails; Guard Rail Clamps; Manganese Track Work; Rail Braces; Rail Expanders; Switches; Switchstands and Fixtures.

Republic Steel Corp. 149
Cleveland, Ohio.
See Toncan Culvert Mfrs. Assn.

Russell Snow Plow Company 232
Ridgway, Pennsylvania.
Snow Plows.

Simmons-Boardman Publishing Co. 166-230-236
105 West Adams Street, Chicago, Illinois.

Stulz-Sickles Co. 236
134-142 Lafayette St., Newark, New Jersey.
Welding Electrodes.

Taylor-Wharton Iron and Steel Co. 231-233
High Bridge, New Jersey.
Castings; Crossings, Rail; Derails; Frogs; Guard Rails; Guard Rail Clamps; Joints, Rail; Manganese Track Work; Rail Braces; Switches; Tongue Switches; Track Work, Special.

Tar and Chemical Division of Koppers Co. 160-161
See Koppers Co.

Tennessee Coal, Iron & Railroad Company 162
Brown-Marx Building, Birmingham, Alabama.
See U. S. Steel Corporation Subsidiaries.

Timken Roller Bearing Company, The 164
Canton, Ohio.
Bearings, Hand Car, Journal Box, Motor, Push Car, Tapered Roller, Thrust; Castings; Steel, Electric Furnace, Open Hearth, Special Analysis; Tubing, Seamless Steel.

Toncan Culvert Manufacturers Association 149
Youngstown, Ohio.
Iron Corrugated Pipe; Iron Culverts; Perforated Culverts.

Truscon Steel Company 172
Youngstown, Ohio.
Bunk Houses; Crossings, Highway; Parts, Shed; Platform Canopies; Slabs, Intertrack; Shop Buildings; Tool Houses; Transfer Sheds; Warehouses.

Union Carbide and Carbon Corporation 141
30 East 42nd Street, New York City.
See Oxweld Railroad Service Co.

U. S. Steel Corporation Subsidiaries 162
Alloy Steels; Bars; Bolts; Cement; Fencing; Fence Posts; GEO Track Construction; Guard Rails; Joint Fastenings; Nuts; Rail Joints; Rails; Screw Spikes; Sheet Piling; Steel Alloy; Steel Plates and Shapes; Structural Steel; Tee Rails; Tie Plates; Ties; Tubing; Wire and Wire Products.

United States Steel Products Company 162
60 Church Street, New York City.
See U. S. Steel Corporation Subsidiaries.

Warren Tool Corporation 167
Warren, Ohio.
Adzes; Bars; Chisels; Forgings; Mauls; Picks; Sledges; Track Tools; Wrenches.

Western Gas Division of Koppers Co. 160-161
See Koppers Co.

White Tar Company 160-161
See Koppers Co.

Wood Preserving Corporation, The 160-161
See Koppers Co.

Williams & Co., J. H. 234
75 Spring St., New York City.
Chain Pipe Tongs; Clamps; Eye Bolts; Hoist Hooks; Lathe Dogs; Thumb Nuts and Screws; Wrenches, Drop Forges, Reversible Ratchet; Vises.

Woodings Forge & Tool Co. 225
Verona, Pennsylvania.
See Woodings-Verona Tool Works.

Woodings-Verona Tool Works 225
Verona, Pennsylvania.
Adzes; Bars; Chisels; Forgings; Mauls; Picks; Rail Anchors; Sledges; Spike Pullers; Tie Tongs; Tracks Tools, Wrenches.

● What a worker! Wherever steel or iron is unprotected—or ill protected—Rust is ready to put in twenty-four hours a day at its work of destruction.

Keep Rust off *your* payroll. The sure way is to paint metal surfaces with Dutch Boy Red-Lead.

Paint made with Dutch Boy Red-Lead provides a solid, tough, tenacious coating—one that not only keeps out moisture but also resists the destructive action of other common causes of corrosion—such as gases, smoke and salt water.

Dutch Boy Red-Lead comes in both paste and liquid form, the latter including a quick-drying type for use when allowable drying time is short. The pigment in every case is pure red-lead that contains more than 97% Pb_3O_4, thus assuring easier application, higher spreading rate and a uniform film of greater density.

For complete information on protecting iron and steel against corrosion, send for our free booklet, "Structural Metal Painting." It covers such subjects as the conditions affecting the life of paint on metal, proper paint formulation, testing and judging the value of paint, estimating areas and costs.

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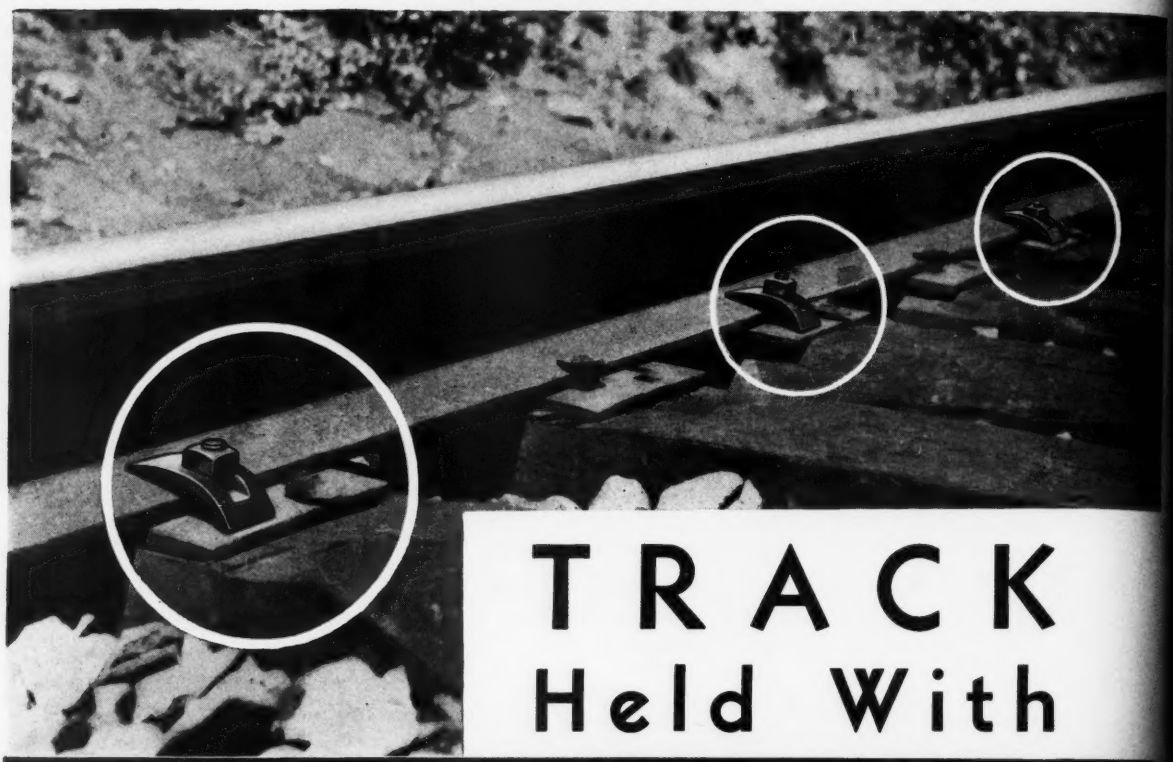

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COMPRESSION Track Fastenings hold the rail firmly against movement in either direction. Their holding power takes effect immediately upon application, and there is no loss of expansion as with the older forms of track construction.

Each and every clip is an effective and independent unit to hold the rail. There are no "loafers" with spring clip construction. Every dollar spent goes for delivered holding power.

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